SD
1
.W93

UNIVERSITY
OF MICHIGAN
SEP 21 1960
FORESTRY
LIBRARY

PR

Pest Control

WORLD CROPS

The International Journal of Agriculture

VOLUME 12, No. 9 SEPTEMBER 1960

The Trojan Bale-Master - revolutionary bale handling equipment - trophy winner at one of Britain's leading agricultural shows

For further details see page 330

A Publication of The Leonard Hill Technical Group

Higher yields on Honshu

Around Aichi on Honshu, the largest of the Japanese islands, the same crop goes into the same soil over and over again. This is a system favourable to the Japanese agricultural economy and one much liked by *Meloidogyne incognita* var. *acrita*, the root-knot nematode. In such conditions nematodes thrive and their presence in the Aichi soil slashed carrot yields by half.

In pesticide trials carried out to beat this scourge, Nemagon proved extremely successful. Ten days before the carrot seed was sown, this effective Shell soil fumigant was injected into the earth. Then, after two months' growth, the carrots were lifted. They showed virtually no sign of damage, weighed nearly double those from untreated soil, and were of greatly improved quality . . . concrete evidence of Nemagon's efficiency.

Nemagon shows equally productive results on other crops. It can be applied after planting as well as before and, in this way, effectively controls nematodes in land growing perennials. D-D, Nemagon, aldrin, dieldrin, endrin and Phosdrin can control nearly every world pest. **Nemagon** *Trade Mark*

YOU CAN BE SURE OF SHELL CHEMICALS

SHELL

Issued by Shell International Chemical Company Limited. For further information apply to your Shell Company.

Editorial Comment

Moving With The Times

YOU ARE holding in your hand a copy of WORLD CROPS with a NEW LOOK—our Eleventh Birthday Number. We hope you like it, not just for its attractive appearance, but also for the quality of its editorial, not to mention its useful and informative advertising pages.

By introducing changes in print and presentation we aim to increase the demand for WORLD CROPS and to make it a first call among our wide and ever-widening circle of readers who want up-to-the-minute news and interpretative articles to explain the latest developments in the exciting and ever-changing world of agriculture.

We now propose to improve our coverage still more. With the January issue we shall commence a new feature, 'World News', which will bring to you reports of new agricultural methods, machines and chemicals from countries where agriculture is responding to the ever-growing demands for more and still more food. We are enlarging our panel of accredited correspondents and invite new recruits.

Our studies have shown that Ministers of State, Directors of Agriculture, research and field officers, plantation managers, farm superintendents, farmers and market gardeners must have prompt news of new developments. They want early news of new machines and of new methods in agricultural industries having a bearing on their work.

In many cases however an administrative organisation, Government department, research institution, group of estates, land development scheme or vast agricultural project, with senior and junior managers, are in receipt of only a single copy which is jealously held in the library or, if circulated, remains long in a single office—'awaiting action'. In general, one copy of WORLD CROPS may be read by as many as 100 readers, but we are not satisfied with this.

WORLD CROPS is a unique journal designed to make people think and act. For a large organisation a single copy is not enough because of the inevitable delays in circulation. We would urge that not less than a dozen copies should be taken by such organisations, so that those at headquarters and those in the field may receive early information and take prompt action.

We hope to enhance the friendly relationship we have established with our wide circle of readers during the past 11 years. We hope, too, that our NEW LOOK will bring us many more new friends.

Thieves at Work

ACCORDING TO a recent report from FAO, world production of cereal grains in 1956, not including the U.S.S.R., was 756 million m. tons, of which at least 10% was destroyed by insects, rodents and fungi, a loss of 75,600,000 m. tons, which, at an average daily ration of 800 g. per person, would have fed 255 million people for a year.

In a world in which millions still go hungry the reduction of such losses of food could play a significant part in the struggle to increase world food supplies. This is by no means a theoretical speculation, because effective measures can now be taken against rats, insects and fungi, and such action is one of the cheapest and quickest means of increasing world food supplies. Infestation may take place while the grain is growing in the field, as soon as it is stored in farm warehouses or at any other time as it is moved by road, rail, barges and ships, or kept in mills, silos, grain elevators etc. The great centres of infestation are, of course, the world ports. Here there are countless opportunities for infestation while grain is being transferred, stored in transit sheds, put in sacks that have not been properly cleaned or while it is undergoing treatment in the flour mills at the docks.

The Loot

The first World War provided a striking example of the losses that can occur. Britain had 3½ million tons of grain stored in bags in Australia, which could not be delivered because of German submarine activity, and so it remained in storage from 1917-19. It was attacked by weevils and damage to the extent of £1 million was done before control measures were started. Control cost £600,000, making the total loss over £1½ million, the largest in history in any one stockpile.

Fantastic tales are told of the damage caused by weevils when grain was carried in sailing vessels. From one shipment of 145 tons of American maize sent to England in 1868, 1¾ tons of weevils were screened out during the following year, an estimated weevil population of 4,056,729,600.

The Bandits

The black, or ship rat is usually found in coastal areas of countries with a warm climate. The rat's prolific breeding habits have made its total destruction very difficult, even when attacked intensively with stomach poisons, fumigants and traps. A 90% kill is extremely rare and the few rats left usually make a quick come-back.

Most farmers know the high cost of rats. In the U.S.A., for instance, it has been estimated that each rat feeding on stored grains costs the nation £2 a year. Again, weevils are most destructive in tropical countries, where they are active all the year round. Losses from fungi vary considerably from country to country, but they often reach serious proportions in very damp climates.

Weapons of Defence

With fast ships and better methods of handling, risks of insect losses are not so great. Rodenticides, insecticides and fungicides are now available in adequate supply to attack the pests. But in many areas there are inadequate facilities for the prevention of losses or insufficient personnel and lack of organisation and coordination of effort.

In countries where grain is grown on large mechanised farms, far-reaching control is possible because the modern handling and storage equipment lends itself to control measures, but in countries where the grain comes from small farms and storage space is inadequate preventive measures are more difficult, mainly owing to the farmers' lack of scientific and technical knowledge.

The most critical areas at present are the humid tropics, such as S.E. Asia, the Near and Middle East and Africa, where the pests breed rapidly and where storage facilities are inadequate.

United Action

Even by using modern methods of control, storage and handling, some countries cannot wage an effective war on pests if neighbouring or trading countries do nothing. Owing to the magnitude and complexity of the problems involved, the attack must be international, because an infestation can be carried thousands of miles. Efforts to introduce effective international control have been made by FAO, but, due to the limitation of resources and staff, these measures have not been carried out as extensively as they should be.

Recently the organisation issued a new call for international effort to prevent storage losses and, in launching the Freedom-from-Hunger Campaign, has placed special emphasis on national action projects to prevent losses in stored grain. The projects involve design, construction and demonstration of improved and inexpensive farm storage facilities and the development of effective methods of controlling pests in farm-stored grains. Efforts are also to be made to train local personnel, to develop pest control techniques and evolve methods for drying grains in community storage centres.

Fear of Change

OUR MODERN age is essentially an age of exceptionally rapid change. The growing pace of today's progress puts a severe strain on us all, for adjusting ourselves to new conditions and new beliefs about the world is always painful. Our grandfathers had a lifetime to adjust themselves to a major change. We must learn to adjust ourselves to major changes at the faster rate of three or more in a lifetime.

Old and familiar beliefs die slowly with many people and it is not surprising that so many fall behind the times. Nor is it surprising that some, with eyes focused upon narrow fields of interest, want to slow down or, in some cases, even reverse the march of progress, for the challenging or shattering of an old belief can be like an earthquake. The reaction is immediate and unreasoned fear.

An opinion survey reported by the Survey Research Centre of the University of Michigan in 1958 showed these revealing attitudes: 83% of Americans felt that the world is better off because of science; 5% gave qualified approval of science; 12% were opposed to scientific advances or could not make up their minds about it.

Superstition is Fear

Fear has been with man since the beginning of time. It arrived with darkness. In the past ages man's fears have made him the victim of astrologers, soothsayers, voodoo men, witch doctors and scaremongers. Not many centuries ago an eclipse of the sun was a cause for public terror. He who could assure the public that the eclipse meant no harm, or the man who could promise that he could save the people from harm foretold by the eclipse, was the man of the moment. He could manipulate the people as he wished.

Today the fear-arousing words are 'atom bomb', 'fall-out', 'cancer' and, to a lesser degree, 'slow poison'. High public emotions can be aroused by shouting or even by whispering these words in public in connection with some event or the introduction of some new agricultural chemical.

Probably our modern age of fear really began in August 1945, when, by the explosion of two atom bombs, we learned that men now could create forces which could destroy mankind. The life-killing ability of so small an explosive package raised the spectre of life-destroying forces of other kinds. Frightening as an atom explosion would be, fear was heightened by the effects of unseen fall-out from hydrogen bombs discovered in 1954.

Lack of dependable knowledge, even on the part of some scientists who speak out of their own fields, adds to the public confusion and fear over very serious questions. For the public, lacking knowledge needed to make a sound judgment on many scientific questions, must rely upon information and warnings given them by reputable scientists and officials. Such information can counsel reasonableness or it can excite widespread fear, active hostility and lack of public confidence generally.

If we are to survive the present age, those in positions of authority must exercise reasonable judgment and wisdom in making public statements and give due consideration to all the factors—benefits as well as hazards—that must be weighed in making a decision in the balanced and best interests of the public. Such men must be above the sway of popular emotions and beyond the hold of popular, and often unfounded, fears.

Rapidly changing conditions of life and widespread fear of unknown elements which science is introducing into modern life form the background against which public policy decisions concerning pesticides are being made today.

Poison on Your Plate?

WRITING IN *Reynolds News* under this scare headline, Merry Archard reports on an interview which she has had with a Mr. Donald Wilson, Secretary of the Organic Food Society, which, it is stated, was specially formed only a few months ago to sponsor a food shop, 'Wholefood', in Baker Street, London. As if to give added weight, it is mentioned that Yehudi Menuhin (famous violinist) and Earl Kitchener are among the seven council members. What any of them know about human nutrition is anybody's guess.

Mr. Wilson is quoted as saying, 'We are terrified of what the scientists are doing with our food . . . I *think* that if we go on eating food *impregnated with chemicals* we will be sterile in *three* generations'.

Have we ever seen Britain's children looking more bonny? Have her people ever been so well fed? Have they ever lived so long and multiplied so fast as they do in these perilous times, when it is more dangerous to cross the street than to eat a fertiliser-fed, chemical-impregnated lettuce, reeking of fumigants, fungicides and insecticides etc.?

The grain eaters of America, the rice eaters of Ceylon, the tea, coffee and cocoa drinkers and the fruit eaters of the world need not worry unduly. Let us leave it to the food cranks to worry themselves into an early grave.

Copyright in Plants

PROTECTION FOR plant breeders, which would give them similar rights under the law as inventors, composers, authors and other creative workers, has been urged by the Committee on Transactions in Seeds. It recommends that breeders should have the opportunity of acquiring rights in their new varieties for limited periods. Thus royalties could be demanded from people licensed to grow or sell the new varieties.

There is a good cause in equity for improving the position of the plant breeder, for plant breeding is becoming more complicated and more costly; rewards are generally small and much sustained effort is entailed.

The argument that some varieties turn up by chance is equally true for some inventions, such, for instance, as the remarkable discovery of the curative properties of penicillin, which really originated from the chance appreciation of the fact, long observed, that penicillin will spread over agar plates and destroy the colonies of bacteria, so that any further count is impossible after the third day. In any case, chance discoveries of new plants must today form only a small part of the total of new introductions.

So far as the private breeder is concerned, we must all agree that this is a move in the right direction; the position of the officer of a business or research organisation, whose breeding work is subsidised by the State or of the seed business which employs plant breeders, needs to be placed on the same footing as rights from inventions. Thus the rights on any invention is the property of the organisation which employs the scientist. That the recommendations of the committee are a step in the right direction and long overdue cannot

'I preferred the flavour of the last lot'

be gainsaid. The next step will be to obtain international agreement so that patent rights in a new variety of seed will be recognised all over the world.

Freer World Trade

SOME 30 YEARS ago, economic nationalism was the prevailing fashion and those nations in a position to do so tried to make themselves self-sufficient by either shutting out or severely restricting imports from other countries by means of a complex system of tariffs, import quotas, barter agreements and currency restrictions, and other countries were forced to adopt similar measures in self-defence. The growing economic tensions, which resulted, led ultimately to war between the leading nations, in which other nations became involved.

Protective measures are justified when a new industry is being established and is in no position to compete, and then only for a limited period of time; they are not sound policy as a means of raising revenue or to give favoured treatment to a number of selected industries. The imposition of tariffs acts as an effective barrier which restricts and reduces the volume of trade, for it encourages counter-measures of a similar nature.

It was largely to prevent the recurrence of this anti-social national selfishness that the idea of a United States of Europe was born and a treaty for the inauguration of a European Economic Community was signed in Rome in March 1957. Its purpose was to foster the exchange of goods and services, put the common resources of Europe to the best possible use for the common good and ensure the most effective use of labour.

To achieve this purpose a European Common Market was to be established with the progressive elimination of tariffs and trade restrictions and the abolition of national barriers to the movement of people, services and capital, as is the situation in the U.S.A. between its constituent states. This idealistic picture is regarded in certain quarters as a good thing, but there are certain features of the European Common Market which give cause for anxiety.

Six European nations, having come to agreement among themselves, have achieved a seemingly indestructible boom and are going from strength to strength. Trade is moving more rapidly between them as new arrangements, business associations and commercial ties are built up, and as a result of the increasing productivity, production costs can be reduced and exports to countries outside the agreement can expand. This in turn will allow them to invest more money in new factories and to replace obsolete machinery in established factories and so improve their position still further.

Thus there can be little doubt about the advantage of the agreement to those within its boundaries, but there are definite disadvantages for those countries, large or small, who for one reason or another find themselves on the outside, and this includes many of the newly self-governing countries of the world.

A highly prosperous 'Six' will further accentuate the growing economic gap between the 'have' and the 'have not' nations of the world, and it will be difficult to convince people in Africa, Asia and South America that there is much regard for their welfare. The obvious reaction will be for the developing countries to protect their economies by introducing tariffs on imported goods to offset the relatively low prices for the primary products that they produce. This is already being done, partly to protect their economies, partly to obtain revenue the easy way, and partly to protect young industries, which may or may not be suitable. This is actually happening and it all adds up to a reduction in world trade, when what is wanted is continuously increasing world trade.

This Month's Cover Picture

—the Trojan 'Bale-Master'—winner of the D. Alban Davies Trophy and Silver Medal at this year's Royal Welsh Show, one of Britain's leading agricultural shows. (Trojan also won last year's trophy with the 'Airator'.)

The 'Bale-Master', operating in conjunction with the Gale bale sledge, completely revolutionises bale handling and, in addition to making drastic cuts in labour cost, can save crops from damage by sudden changes in the weather. The 'Bale-Master' lifts, carries and stacks up to 40 bales at a time and is operated by the tractor driver from his seat.

Throughout the world 'Bale-Masters' are being employed for a thousand and one other useful jobs, including the handling of sacked produce, packaged goods and bulk materials. With a platform fitted, this invaluable item of equipment can be used to great advantage when hedge trimming, painting and repairing buildings etc.

TROJAN AGRICULTURAL SALES,
Lambretta Concessionaires Ltd.,
Trojan Works, Purley Way, Croydon, Surrey, England

s,
d
of
e
e
lt
a
s
ct
d
y,
n
g
s
n
y

960

Small Sprayers and Dusters

Requirements of Small-scale Agriculture in the Tropics

R. J. COURSHEE, B.SC.*

An example of a prefabricated syringe sprayer

Much of the agriculture in the less developed countries is carried on by small farmers, often owning less than 2 acres. If agricultural productivity in these countries is to advance it is necessary to provide the farmers with the most suitable tools for such small-scale operations. The author discusses the merits of small and large plant protection machines, for individual ownership and for machinery pools.

THE machines used for applying chemicals to crops vary considerably in size, in price and in the type of work that they can do. Nevertheless, a spraying aeroplane and a hand sprayer have similar functions, even though they operate in very different ways. Such differences are often superficial, since the primary purpose in all cases is simply to apply chemicals. This they all do in their various ways, each fulfilling a different requirement.

Implements for the smallholder

Several factors need to be considered to ensure the selection of the right class of spraying machine and of the right machine in its class. It is particularly important to make a correct selection wherever chemical methods of plant protection are being introduced into small-scale subsistence agriculture, *i.e.* peasant farming. For this type of agriculture produces no cash crops, and it is difficult for the smallholder to afford even a small expenditure on pesticides and also buy

An Indian farmer using a simple form of concertina duster

* Department of Horticultural Engineering, National Institute of Agricultural Engineering, Silsoe, England.

a sprayer or duster, even if considerable benefit is to be expected from the outlay. The purchase of an unsuitable machine would be a disaster for a poor farmer and it is essential for him and his advisers to be right when they decide to buy.

The cost of farm tools for more basic purposes—soil cultivation and irrigation—has to be found even on the most under-developed farm. The cost of these may be small, but an expensive tillage machine may also be obtained if, as is often the case, it provides the farmer with a profitable investment. In plant protection, on the other hand, the benefit to be derived from buying a spraying machine or a duster is not always so obvious, nor usually so great, as it is with an irrigation pump.

Sometimes chemical plant protection shows a large profit, but in subsistence agriculture, with low yields and meagre cash returns, it is more often only of small value to the farmer. There is also the possibility that the treatment will fail on occasions to be fully effective. The one exception is seed dressing, where a very small expenditure produces valuable results, almost unfailingly.

So there is usually a doubt in the small farmer's mind about both the value and the success of controlling pests with chemicals, and the greater the cost of the treatment the greater will be his justifiable doubt. Moreover, even where the farmer is convinced of the value of plant protection, he still views with some mistrust the purchase of a machine which to him is complex, expensive and likely to be used for only a few days in each year. So the resistance to the purchase of a machine with which to apply the pesticide is considerable and the farmers instead ask for machines to be hired or loaned to them.

Subsidies and machinery pools

Accordingly, pesticides are often subsidised and machines are hired out at small charge from pools of equipment, owned by governments. It is commonly thought that, because of the price of the machines and because of the farmer's attitude, such hiring arrangements are essential. It is suggested, however, that when introducing chemical plant protection these pools can be more of a hindrance than a help and that in any case they are not necessary. This is because the type of machine which would be most useful to the farmers is one which does not have to be hired from a machinery pool. If large and relatively expensive machines become essential, then arrangements may be needed for hiring them. Conversely, if machines can be of such a type, performance and price that the farmer believes he can own one himself, then borrowing facilities are not necessary.

The type of machine which could replace the present pool machine would need to be robust, reliable, cheaper, mechanically simple and, above all, standard. Then the farmer would be able and probably willing to do the small amount of maintenance work necessary. The performance of the machine would need to be equal, in terms of biological effectiveness, to the performance of the pool machinery. The cost of the machine to buy, maintain and operate would have to be small compared with its value and also within the small farmer's means.

In the first place, such simple machines do exist. Secondly, simple sprayers and dusters are both effective and economic in the circumstances being considered. Thirdly, individual ownership of, and responsibility for, a machine is desirable on grounds of timeliness in spraying and efficiency in operation and maintenance. For these reasons pools are unnecessary and may even cause obstacles to the introduction of spraying and dusting.

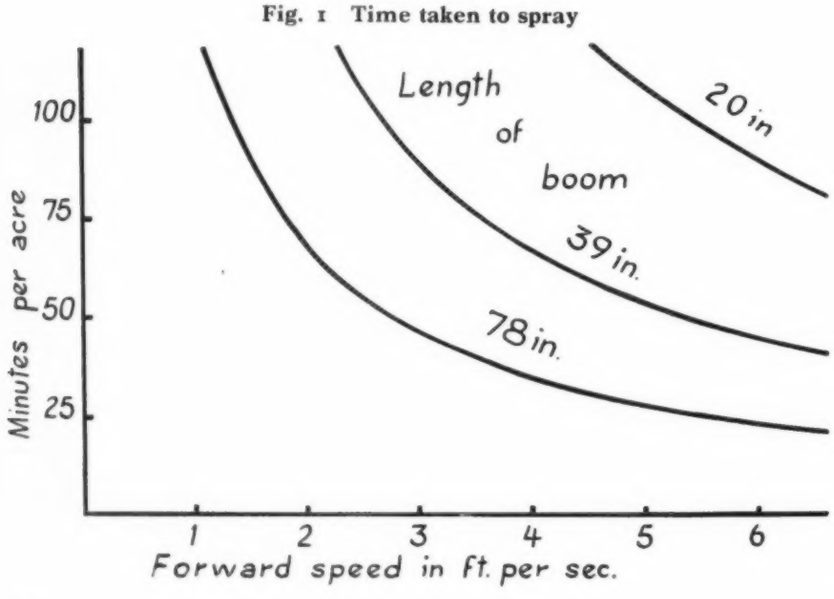
Function of a sprayer

All that a sprayer or duster has to do is to distribute at a particular time a certain chemical at a required density over a crop or area of ground. The distribution of the chemical from plant to plant, from leaf to leaf and also over each leaf must reach a standard of uniformity which can be defined approximately for any given pest and pesticide. It must do this in the prevailing circumstances at a satisfactory speed and acceptable cost.

A small and cheap machine can be quite as effective as a large and expensive machine. This is most easily seen with a duster. All dusters do little more than provide a stream of air laden with the requisite amounts of dust. The smallest bellows duster and the largest motor-driven machine both do this, and they both use the same dust and the same air. The main difference is that the large machine can treat many more plants in a given time and can reach to more remote targets. The user of a hand machine progresses more slowly and he must move himself to bring the target area within the range of his machine.

The same is true of sprayers, although here it is less obvious. For example, experimental plot work is often done with hand knapsack sprayers, not only because they are convenient for the small areas to be treated, but also because more thorough and more consistent spraying is possible with them than with many more powerful automatic machines. The larger machines, however, work more quickly and usually more cheaply.

Fig. 1 Time taken to spray



Bias towards large machines

It rather seems that those who select machines for the machinery pools tend now to favour the larger types, claiming that these are more effective than the small machines. If a small machine under certain conditions does fail to achieve control over a pest, whereas a larger machine using the same chemical programme succeeds, then this can only be because the instructions for using the small machine have not been prepared correctly or they have not been followed. Half of the private gardeners in England who apply pesticides to their crops obtain quite adequate results merely by using a simple syringe or even only a watering can.

One might well ask, then, what is the purpose of the larger and more complicated and expensive machines, and, of course, the usual reply is that they are quicker and cheaper to use and therefore preferable under most circumstances. It is shown below, however, that small machines are not hopelessly slow and in some situations they are not impossibly expensive. The cost of the work depends upon who is paying and what he is paying with. In subsistence agriculture and on smallholdings, labour costs do not arise, whereas on farms employing hired labour they certainly do.

Rate of work

For both dusters and sprayers any arguments for or against the small machines should be based, not on questions of effectiveness, as is often done, but on the much more straightforward points of speed and cost of the work done with them. How slow are these very small machines and how fast do they need to work? How costly are they to buy and how expensive are they to use and maintain?

In Fig. 1 the rate of work obtainable with small machines is illustrated in terms of the product of forward speed and width of swath covered in each passage of the sprayer. No allowance has been made for refilling time, time taken to bring up water or for breakdowns.

Useful rates of work are clearly attainable and a 2-acre plot can be treated quite comfortably in a few hours. This is probably the largest size of plot which needs to be considered. If a man can do all the required work in one day, does he really need a faster machine?

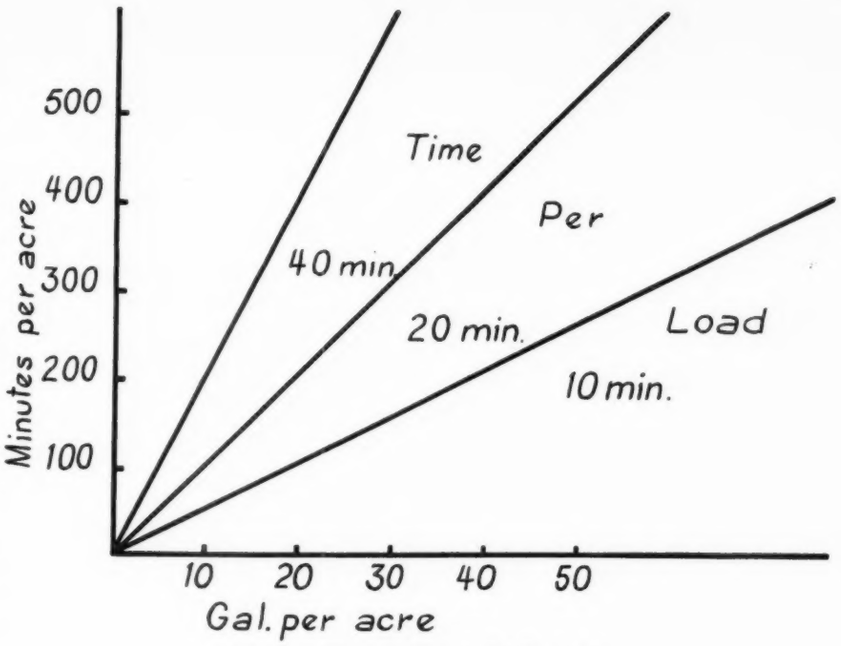


Fig. 2. Time taken to fetch water

Pumping a limiting factor

If a man is going to pump as he moves along, then at a pressure of, say, 2 atm., the spray delivery is limited by the energy available to about 2 gal. per min. These figures are not exact, but they do suggest that about an hour's continuous pumping is needed at this pressure to pump 100 gal. So if 100 gal. an acre were to be applied, the limitation upon progress would not depend upon how quickly the man can cover the ground, but upon whether or not he can pump without rest. If, on the other hand, 10 gal. per acre only is applied, then pumping is not a limiting factor on speed of work unless high pressures (10 atm.) are needed.

Factor of water supply

Large-volume spraying by hand is exceptionally slow when water supplies are remote from the field under treatment. Usually the water is carried by hand in 1- or 2-gal. loads. Fig. 2 shows how time-consuming the fetching of water can be.

In the more advanced countries the disadvantages of large-volume spraying are not important. The cost of water in the field is small, as another standpipe or another spray tanker can be put into service when necessary and the capacities of power-driven pumps rarely limit the progress of the work. When, on the other hand, the spray has to be carried, pumped and applied by hand, small-volume spraying is a far more attractive proposition than large-volume spraying.

So for the reason that small-volume spraying is almost essential in these circumstances if the work is to be done by hand, it has to be made as effective biologically as large-volume spraying. Pesticides, formulations and programmes will have to be chosen to suit small-volume work. This is also true for small-volume dusting.

Providing this can be done, even the smallest hand-powered machine is probably acceptable, since it is able to work quite quickly enough on the small plots of a single crop grown by peasant farmers. Using such a machine is, however, hard work and confers none of the prestige associated with a powered knapsack sprayer. As regards cost, the small machines appear in a more or less favourable light, depending upon the viewpoint taken.

Factor of cost

The sort of machine which a small farmer can probably afford is one which costs about as much as the pesticide which he uses annually. Most farmers have a far larger investment in sprayers than this. So this capital cost, in fact, under-estimates the

amount which a farmer is usually willing to pay. Effective, efficient and easily used machines could be made available for such a small sum (perhaps 10s.), but they would have to be designed to permit mass production for the cost to be low enough. This would have the added advantage of ensuring standardisation and simplicity. Hand-made sprayers and dusters are usually far more costly and less suitable in several ways than those made by machine.

The sprayers or dusters would have to be hand powered, so their labour requirement would be high in relation to that of more powerful machines. So really the small cheap machines are not economical in the sense that much effort is consumed which might be used productively in other ways.

If this high labour need had to be paid for in cash, such slow machines would be considered less economical by whoever is paying than machines which work with a smaller labour consumption. But this is not the position. The small farmer does the work himself, is not often hard pressed for time and the only cost he has to meet is the price of the machine and its replacement parts. For him a cheap machine which works only slowly is economical if it is quick enough, and he has little use for a machine which works more quickly if it costs more.

Small sprayers and dusters

The cheapest and most simple of sprayers is the syringe and amongst dusters the concertina duster. Suitably designed and well made, these two can meet satisfactorily most of the chemical plant protection requirements of small-scale subsistence agriculture. Designs for such machines are available, but perhaps it would be better for plant protection officers to develop designs suited to national conditions.

Farmers are generally conservative and it may be quite difficult to persuade a poor farmer to accept chemical methods of protecting plants without helping him. It will be easier to persuade him to use a small machine which he can own and maintain himself and use at the right time than to hire more complex machines borrowed in doubtful condition, and obtained at some inconvenience from a distant machinery centre. Later on he may be able to afford and may need other machines, but to begin with the best machine is the cheapest one so long as it is a reliable and efficient tool.

Conclusions

To sum up, small machines, used properly, are biologically effective and, for the amount of work to be done, are sufficiently speedy when used to apply either dust or small-volume sprays. If they are of suitable design and made in quantity, they would be cheap to buy and, being machine-made, they could be simple, robust and standard and so easy and cheap to maintain. But spraying with them is relatively laborious and therefore, in theory, they are more costly. Such machines will depend for their effectiveness on programmes, pesticides and formulations for small-volume spraying and small-volume dusting, so developments may be required in these directions.

The evidence does suggest that pools of such machinery are probably not necessary. Since also machines in pools are usually non-standard, complex and ill-used by various people, they are often defunct or only partially effective. A different set of instructions for its operation is required for each variety of machine, so that unskilled farmers often do not know how to do a good job. They may be obtained only with some difficulty and often cannot be borrowed when they are required. Such sprayers as those proposed and the means to mass produce them appear to offer a valuable form of aid to small - scale agriculture in under-developed areas.

Pesticides Research

The Pesticides Group of the Society of Chemical Industry recently visited the University of Bristol Agricultural and Horticultural Research Station at Long Ashton. The party was received by Dr. J. T. Martin, the Assistant Director, who described the history and development of the station during the 57 years of its existence. Talks were then given by members of staff studying problems relating to pest control.

Dr. D. Woodwock described his work on the relationship between the chemical structure and the biological activity of compounds in groups of fungicides and on the metabolism of organic compounds by fungi. Dr. E. Somers dealt with the mechanism of fungicidal action, with special reference to the uptake by fungal spores of organic compounds and metal ions.

The influence of formulation on the efficiency of sprays and the properties of the chief classes of wetting agents were dealt with by Dr. C. G. L. Furmidge. Dr. N. G. Morgan examined the factors affecting the biological efficiency of spray materials in the field; he showed the importance of the nature of the spray target, explained methods for the examination of deposits, and drew comparisons between large- and small-volume application. Mr. T. Cobbald described work on spray nozzle design and on the mechanics of spray applications in the field.

After a tour of the laboratories, the thanks of the party to Professor H. G. H. Kearns (Director) and members of the staff were cordially expressed by Dr. E. E. Turtle, the chairman of the Pesticides Group.

FAO Group on Coconuts

The FAO Coconut Working Party meeting in Rome has estimated that 1,100,000 tons of copra and coconut oil (oil equivalent) would be available for export in 1960. The chief factor in future supplies will be rising production in the Philippines. From July 1960 a more than seasonal increase in output may raise Philippine exports of coconut and coconut oil for the year to the equivalent of 950,000 tons of copra.

However, since the beginning of 1960 coconut oil prices have fallen by about 25% and some further reduction might be expected with increased supplies.

The Group stressed the importance of research on four major diseases of unknown cause, the most serious of which is 'cadang-cadang'. This disease, unless checked, threatens to wipe out coconut in the Philippines, which is the world's biggest exporter.

Photos: Shell

Applying 'Phosdrin' to Primo cabbages to control an infestation of cabbage aphids, Brevicoryne brassicae. *Three oz. of active material were applied in 50 gal. of water per acre to the crop four days before harvest*

A Consumer-Safe Insecticide

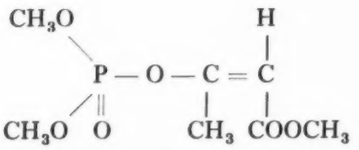
J. B. WINFIELD, M.A.*

UNTIL recently the farmer could do little to deal with insects near to harvest time, for most of the existing pesticides cannot be used then, since toxic residues might remain in the crop. Few of the pesticides which may be used at this time are really effective against the pests. This need for an effective insecticide with short residue persistence is being met with 'Phosdrin'.† Highly effective against a very wide range of insects and mites, it is broken down within the plant and can be used with complete safety to the consumer in some cases up to 24 hours before harvest.

Insect attacks close to harvest remain an important problem in agriculture. Especially is this so in the field of vegetable growing, where late pest attacks can rapidly reduce harvest value not only by destroying the crop, but also by contaminating it and spoiling its appearance.

Its characteristics

'Phosdrin' is an organo-phosphorus insecticide which acts by systemic transmission within the plant and also by a considerable contact and fumigant effect. Chemically it is a 3 : 2 mixture of *cis* and *trans* isomers of 2-carbomethoxyl - 1 - methylvinyl dimethyl phosphate, the *cis* isomer being several times more insecticidally active than the *trans*.



The cis isomer of 2-carbomethoxyl-1-methylvinyl dimethyl phosphate.

At normal temperatures it is a liquid completely miscible with water and so can be used as an aqueous solution, but since it is subject to hydrolysis it cannot be stored in this form; it is therefore available commercially as the 100% material or as an emulsifiable concentrate.

Hydrolysis of 'Phosdrin' proceeds faster under alkaline conditions and at *p*H 11, the half-life is 1.4 hours, compared with 30-35 days at *p*H 7. Within the plant the chemical is swiftly broken down to non-toxic products by enzyme action, its half-life being in the region of 20 hours. Its volatility‡ and high rate of absorption ensure that the chemical does not persist long on plant surfaces: treated crops can be handled a few hours after spraying and are 'consumer-safe' within a day or two.

Non-persistent residues

The extremely rapid breakdown of this compound within the plant results

* Shell International Chemical Co. Ltd.
† Shell trade mark.
‡ Vapour pressure = 0.0029 mm. Hg. at 21°C.

in residues from normal applications falling to 1 p.p.m. a day after treatment, and after three or four days practically none can be detected. In addition, the residues continue to break down at an undiminished rate in the harvested crop.

The safety to the consumer of such applications made close to harvest has been proved many times by chemical and biological residue measurements and has been accepted by many government authorities throughout the world. In the U.S.A. 'Phosdrin' may be used up to 1-4 days before harvest (depending on the crop), and in Canada pre-harvest intervals of 1-3 days are approved. Elsewhere, it is customary to apply one interval between final application and harvest to all crops, and approval has been granted in many countries for use of this chemical up to two, three or four days before harvest, as Table 1 shows:

Table 1

Australia	3 days
Belgium	4 days
Germany	4 days
Greece	2 days
Holland	4 days
Philippines ..	3 days
Sweden	4 days
United Kingdom ..	3 days

In France this is the only systemic insecticide which may be used on market garden crops, whatever the stage of growth, and here a pre-harvest interval of seven days has been approved.

Such pre-harvest intervals allow a considerable margin of safety, as comparison with the U.S. residue tolerances will show. These tolerances are the concentrations of insecticide residue which may with complete safety remain in the crop at harvest time. They are very carefully determined for each crop and themselves include a safety factor. When the U.S. recommendations are adhered to the residues in harvested crops are well below the tolerance limit.

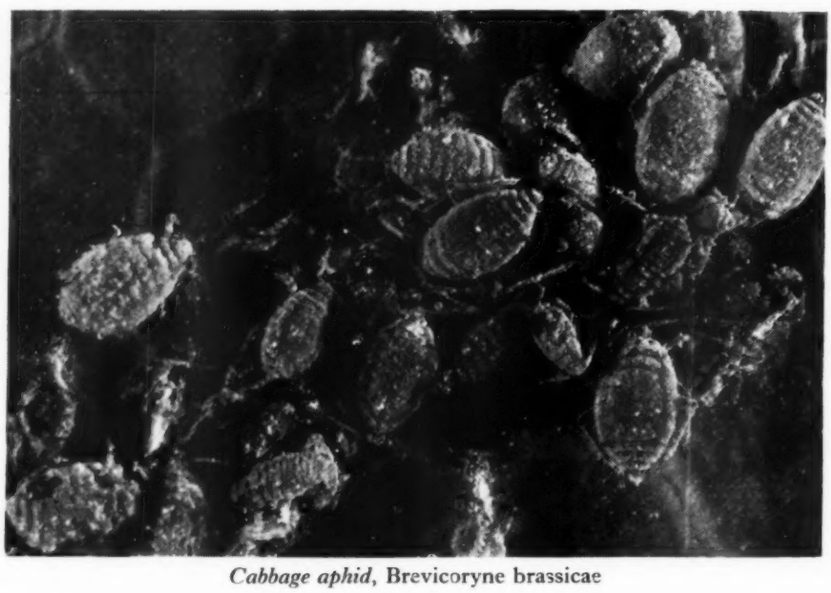
High insecticidal activity

'Phosdrin' is remarkable not only for the short persistence of its residues, but also for its rapidity of action and its effectiveness against a wide variety of pests. Its rapidity of action is helped by a high rate of absorption and upward and lateral translocation within the plant. When it is painted on to the lower leaves of a broad bean plant, the upper leaves, which are out of direct contact with the insecticide, achieve their maximum toxicity within 1¼ hours of application. Thus the chemical disperses rapidly throughout the crop and gives a quick kill of even the most inaccessible pests. When used in trials on beans in Greece this insecticide gave almost complete control of aphids within 30 minutes of application (see Table 3).

Its wide range of activity is particularly unusual for a systemic insecticide. As well as possessing better aphicidal and acaricidal properties than most systemics, it is extremely effective against Lepidopterous larvae and controls most pests of the orders Thysanoptera, Heteroptera, Homoptera, Coleoptera, Hymenoptera and Diptera.

Table 3
Mortality of aphids *Doralis fabae* and *D. frangulae* on beans

Insecticide	*Concentration,* %	% *mortality after* 30 *min.*	3 *hours*
TEPP:			
40% E.C.	0.2	65	80
40% E.C.	0.3	70	85
'Phosdrin':			
24% E.C.	0.05	95	100
24% E.C.	0.1	98	100



Cabbage aphid, Brevicoryne brassicae

Table 2
Residues and residue tolerances

Crop	*U.S. pre-harvest interval, days*	*U.S. tolerance, p.p.m.*	*Dosage rate, lb./acre*	*Residue after U.S. interval, p.p.m.*	*Residue after interval of 3 days, p.p.m.*
Cabbage ..	1	1	0.50	0.26	0.15§
Strawberries	1	1	0.50	0.58	0.16§
Plums ..	1	1	0.32	0.8	0.06
Lettuce ..	2	0.5	0.25	0.24	0.06
Peas ..	1	0.25	0.25	0	0

§ After two days.

Aphids

Against aphids 'Phosdrin' is recommended at dosage rates between 125 and 250 g./ha. (2-4 oz./acre). Rates well below this are often effective: for example, in the field trials 90 g./ha. gave 99.9% mortality of *Pterocallidum* sp.; a 0.009% spray gave 99% mortality of *Aphis pomi*, and a 0.005% spray gave 100% mortality of *Myzus cerasi*. But at these low levels the method of application becomes critical and poor dispersion, coupled with adverse weather conditions, may result in failure. The recommended rates ensure complete aphid control and a high degree of reliability, a total kill being normally obtained a few hours.

Mites

Against adult mites 'Phosdrin' gives

complete control at dosage rates as low as 150 g./ha. Coulon[1] found its L.D.50* to be 48.4 g./hl. of spray against *Tetranychus telarius* eggs and 1.1 g./hl. against the adults:

Table 4
L.D.50 of various acaricides

Acaricide	*L.D.50 in g./hl. spray*	
	Eggs	*Adults*
Tedion	0.86	—
Kelthane ..	10.1	3.2
'Phosdrin' ..	48.4	1.1
Aramite.. ..	64.6	—
Phosphamidon..	>126	0.64
Parathion ..	> 75	2.4

In Table 4 it is seen to compare very favourably with the specific acaricides and is notably more effective than parathion against both stages. These results have been supported many times in practice, when very low dosage rates have given complete control of adult mites.

Lepidoptera

Lepidopterous larvae are important pests which 'Phosdrin' controls most effectively. Gast[2] found that this chemical was far more effective than the conventional insecticides when applied as a contact spray against larvae of *Heliothis* spp. The L.D.50 values from these laboratory trials are seen in Table 5.

Table 5
L.D.50 against *Heliothis* spp.

Insecticide	*L.D.50 gamma/g.*	
	H. virescens	*H. zea*
Toxaphene ..	18,000	2,000
DDT	6,500	3,000
Endrin	180	17
Malathion ..	160	130
Dipterex ..	60	30
Parathion ..	54	40
'Phosdrin' ..	4.8	4.8

Excellent results have been given against cabbage caterpillars, and it is proving invaluable in protecting this crop near harvest, when insecticides of long persistence, such as endrin, cannot be used.

World-wide application

In Europe 'Phosdrin' has been used mainly on vegetables and fruit to control aphids, mites and caterpillars.

*L.D.50: Symbol indicating the amount of pesticide necessary to kill 50% of the organisms in the test.

Bean aphid, Doralis fabae, *controlled by 'Phosdrin' within 30 minutes of application*

Table 6
Mortality five days after application to cabbages

Insecticide	*Pieris rapae*, %	*Trichoplusia ni*, %
'Phosdrin', 500 g./ha. ..	98	100
Demeton, 1,000 g./ha. ..	98	68
Malathion, 1,000 g./ha. ..	70	42
Parathion, 250 g./ha. ..	79	16

Other pests are also important, however, and it has been used, for example, on spinach to control the beet fly, *Pegomyia hyoscyami*, and on peas to control the pea moth, *Laspeyresia nigricana*, and the pea weevil, *Sitona* sp. This is proving a particularly valuable insecticide to farmers growing crops for canning and freezing, where contamination of the crop can be a very serious problem and where the actual date of harvest may not be known until shortly beforehand.

Outside Europe, *e.g.* the Philippines and Thailand, 'Phosdrin' has achieved great success against vegetable and fruit pests. In Australia it is used on brassica crops in Victoria, and here it has given better results against *Pieris rapae* and *Plutella maculipennis* than the long-persistent insecticides. In addition, it controls the aphid, *Brevicoryne brassicae*, and can be used at any time up to three days before harvest. In the U.S.A, where the product has been marketed since 1957, it is very widely used on vegetable crops and on soft, deciduous and citrus fruits. In addition, its use is extending to forage crops and to tobacco.

Use on non-edible crops

The use of 'Phosdrin' is by no means confined to close-to-harvest use on edible crops. Its high biological activity had led to its preference over more persistent insecticides in applications well before harvest time and on inedible crops. Thus in Equatorial Africa it was used in 1959 on more than 4,500 ha. of coffee to control the leaf miner, *Leucoptera coffeella*, and the leaf-eating caterpillar, *Epicampoptera*. For this application the chemical is used at a lower rate than other organophosphorus insecticides and it does not kill the important natural parasites of the pests.

In France successful control of the aphid, *Aphis fabae*, on sugar-beet was obtained last year when it was used at 250 g./ha., whereas methyl demeton was used at 500 g./ha.; both insecticides gave control for 8-10 days.

On vines and tobacco

On tobacco 'Phosdrin' is being used by the Tobacco Board in Greece for the control of aphids and thrips. It is preferred because of its short residue persistence in the crop and because it does not taint or alter the flavour of tobacco. In South Africa it has proved highly successful in trials for the control of the tobacco leaf miner, *Phthorimaea operculella*.

Peas with emerging grubs of the pea moth, Laspeyresia nigricana, *which can be a serious problem when peas are grown for canning or freezing. It can be controlled by application of 'Phosdrin' close to harvest*

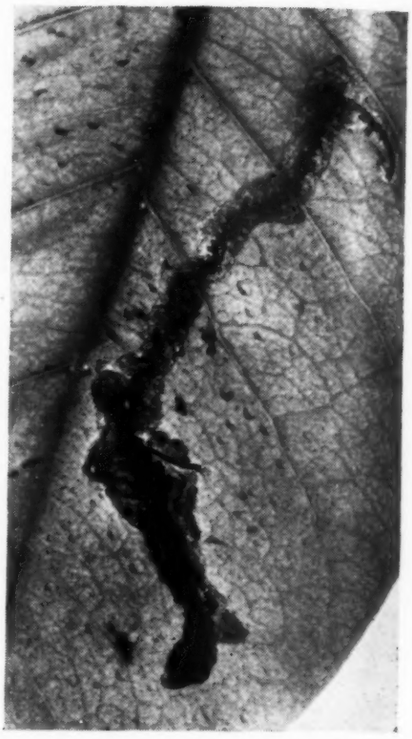
On vines 'Phosdrin' is already approved in Germany for the control of the caterpillars *Clysia ambiguella* and *Polychrosis botrana.* Trials in France against the same pests have also been extremely successful, 100% control being given by dosage rates of 40-50 g./hl., while, in addition, it gave complete control of red spider and *Tetranychus urticae* for up to six weeks.

Summing up

The short persistence of ' Phosdrin ' residues and the fact that crops can be treated a few days before harvest with complete safety to the consumer, make it an insecticide of primary importance for application close to harvest or late in the season. However, its excellent initial kill, coupled with some ovicidal activity and very limited effect on natural predators and parasites, enables it to give control of pests which lasts for a considerable time; this extreme effectiveness makes it suitable also for use as a general-purpose insecticide.

REFERENCES

1. Coulon, J., *Phytiatrie-Phytopharmacie,* 1958, **7,** 127.
2. Gast, R. T., *J. econ. Ent.,* 1956, **49,** 3.



Portion of a coffee leaf showing damage caused by the coffee leaf miner, Leucoptera cofeella. *These larvae living within tunnels in the leaves can be controlled by 'Phosdrin'*

Good Prospects for Timber

The continuing economic expansion in Europe has had a beneficial effect on the timber industry. In most countries easier credit conditions have stimulated house building, and increased production in other wood-using industries has led to a substantial increase in consumption, and so the market for timber is strong and buoyant, according to the latest 'Timber Bulletin for Europe', published jointly by FAO and the U.N.E.C.E.

This increased consumption will be met mainly by increased deliveries from Austria, Finland, Sweden and the U.S.S.R. Final figures for the season are expected to be about 925,000 stds.* and 935,000 stds. from Finland and Sweden, and some 900,000 stds. from Russia.

The 'Timber Bulletin' states that the high level of consumption reached in 1959 will be maintained in 1960, and it is considered that 1960 will be a stable year for the European timber market.

*Std.: a Standard: 4.67 cu. m.: 1.980 board feet sawnwood.

Soviet Union members of the FAO working party on the development of forestry machinery, which visited the Forestry Exhibition at Harrogate in May. They are seen here on the Forestry Commission stand inspecting a Fordson 'Power Major' tractor

Success with Safflower

P. RYAN

Safflower, Carthamus tinctorius, has been proved to be a promising new crop for Australia. Safflower oil obtained from the seed is a paint oil and the residual cake, being rich in protein, is used as cattle feed.

SAFFLOWER, or kardiseed, is an erect thistle-like plant growing from 2-5 ft. high, with white, yellow or orange flowers. Its white oil-bearing seeds are similar in size to those of the sunflower. The plant grows a vigorous tap-root often penetrating to a depth of 6 or 7 ft. and consequently it is comparatively drought-resistant.

Although only a recent introduction to Australia (see p. 367), safflower has been grown as an oil crop and dye in the Middle East and in India since ancient times. It has already been grown successfully in Queensland and experiments at the Kimberley Research Station in the far north-west of Australia have shown that the crop can also be grown there in an area formerly only suitable for cattle raising.

The Research Station, operated jointly by the Western Australian Government and the Australian Commonwealth Scientific and Industrial Research Organisation, began trials with safflower in 1951 and the work has been intensified during the past three years.

It has been found that under local climatic conditions, safflower must be grown as a dry winter season crop under irrigation. In recent years, as farming experience with the crop has increased, yields have been between 2,000 and 3,000 lb. per acre. The oil content varies between 25 and 40%, depending on variety and time of planting.

The varieties which have proved most suitable for Kimberley conditions are mainly derived from Egyptian material. The variety at present recommended for commercial cultivation, described as '4 (1)', has an oil content of 33-35%.

Uses

Safflower oil properties lie intermediate between those of linseed and soya bean oils. The oil is mainly used in paint manufacture and to a lesser extent as a linseed oil substitute by the floor-covering industry. Paints and enamels made from it show outstanding non-yellowing properties.

At present only a small proportion of safflower oil is used for human consumption. However, it has been claimed that, because of its high content of unsaturated glycerides, the inclusion of safflower oil in the diet may be of value in maintaining low cholesterol levels in the blood and consequently reducing the danger of coronary and arterial diseases. If this claim can be substantiated, a considerable increase in demand for the oil can be anticipated.

Safflower meal, the cake which is left over after the oil is extracted, is a valuable feed for livestock, as the meal from the unhusked seed contains about 18% protein.

The production of safflower seed in the Kimberleys could thus have considerable impact on the local cattle industry, as well as provide a useful raw material for the paint industry.

Safflower plant showing leaves and flower heads

Too Cold for Pears

A new and safe measure against heavy pear losses in cold storage or during shipment has been introduced in New Zealand as a result of a scientific study of the freezing points of pears.

For many years pears were kept in cool stores at temperatures between 29 and 31°F. The lower the temperature, the longer the fruit kept—unless they froze, and then they were no use when thawed and had to be discarded. Some serious losses in stores kept at the accepted temperature led to the initiation of research by Mr. D. C. Marshall, of the Auckland Industrial Development Laboratories, on behalf of the Apple and Pear Marketing Board.

Using specially designed electronic equipment and miniature temperature-sensitive equipment, built into small hypodermic needles, Mr. Marshall developed a method of measuring the freezing points to within a tenth of a degree. Pears were found to have a much higher freezing point than had previously been thought. The difference was 2° or greater—quite enough to mean the loss of many pears through freezing.

The freezing point was found to vary with variety and season and measurements are therefore now made of each batch of pears for storage and the temperature adjusted accordingly.

Pigeons in Persia

R. A. BISHOP

In many countries pigeons are regarded as a pest and poisoned grain is sometimes used to destroy them. The author here considers the economics of pigeon keeping.

PIGEON towers are a common sight in the agricultural country around Ispahan, in Central Iran. Built for the manure provided by the pigeons, they are up to 60 ft. high and 30 ft. wide and have as many as 50,000 pigeon holes. A description is to be found in a previous article[1], where the subject is considered from the point of view of the effect of the pigeon towers and pigeon guano on soil fertility and crop yields, since manures and fertilisers are difficult to obtain.

There remains the question: Why are pigeon towers considered desirable in Iran, whereas in many other countries pigeons are regarded as a pest which do much harm and little good to agriculture? This is all the more remarkable in view of the poor yields and low total production and the need to use as much of the grain crop as possible for human consumption. Since the margin of subsistence is so small, it would seem that a pest like pigeons should scarcely be tolerated.

The profit

The answer seems to be that gain accrues to the owner of the pigeon tower in the form of sale receipts for the manure produced. The costs, apart from relatively minor maintenance charges for the structure and feed required for short periods when the ground is covered by winter snow, are, however, borne by all farmers in the village through grain being taken from their fields by the pigeons. The pigeon towers are only to be found in irrigated farming areas, for very little is grown in the surrounding uncultivated desert.

In view of the lack of relevant information, it is difficult to draw up an exact account of the costs and returns for pigeon towers. Dewan in his article states that guano production from one tower varies between 1,320 lb. and 6,600 lb. a year. In Ispahan the price of guano is stated to be between 20 and 25 rials* a kilo (10d. per lb.). Thus the gross return from a pigeon tower may be between 12,000 and 75,000 rials (say, £55-£350).

There is no doubt, then, that a pigeon tower is a profitable asset and a source of much revenue by local standards for its owner.

Stork's nest on top of small pigeon tower, Nyafabad, Ifahan

* 1 rial = 1.1 penny.

The cost

Unfortunately, this account gives no indication of the number of birds involved, nor of their grain consumption. The only method of arriving at costs and returns is to derive them from related information given in various manuals on poultry management.

J. M. L. Esteban, in 'Manuel d'Avriculture', states that the amount of guano provided by chickens is roughly proportionate to body-weight and grain consumption (see Table 1).

Table 1

Breed	*Average body weight (kg.)*	*Guano produced annually (kg.)*
Leghorn ..	2.0	8-9
Castellane ..	2.2	9-11
Prat	2.75	12-14

The smallest domesticated pigeon breed, the Mondain, weighs on average some 500 g.; it seems unlikely that Iranian pigeons in pigeon towers would weigh more than that. On this basis Esteban's figures give a production of, say, 2 kg. of guano per bird per year.

As regards feeding, Heuser† states that in the U.S.A. 100 pairs of King pigeons eat about 27 lb. of grain a day, and from another trial that the annual grain requirement per pair of pigeons is 101 lb. Perrin, another writer, states that a couple in captivity eat 120-140 g. of grain a day, which accords reasonably well with Heuser's figures.

On the basis of these figures, production of guano per pair of pigeons would be of the order of 4 kilos per annum and grain consumed would be about 45 kilos per annum in round figures. The price of grain varies from 4.5-7 rials a kilo, depending on the

† *Feeding Poultry*. 2nd edition. Chapman and Hall Ltd., London, 1955.

time of year. Assuming, then, that the grain consumed by the pigeons is worth 5 rials a kilo (2d. per lb.), their total annual consumption may be valued at 225 rials, and their guano production at 80-100 rials. There is no other production to include, as dead pigeons are not normally on sale in the shops because the killing of pigeons from pigeon towers is prohibited.

The conclusion

Naturally these figures are approximations and do not show more than the order of magnitude. The important point is that the pigeons seem to cost about twice as much to keep as the value of the manure they produce. In effect, the only reason why pigeon towers are a commercial proposition is because a large portion of the cost is borne by people other than the proprietors of the towers. The conclusion remains, therefore, that the pigeon towers are an example of social loss being converted to private gain.

REFERENCE

1. Dewan, M. L., 'Pigeon Towers and Pigeon Guano in Iran.' *World Crops*, 1955, 7, 102.

Pigeon tower beside an irrigated field, Gavart, near Ifahan

India—

Co-operative Farming

By the end of the next two years, during which many co-operative farms are to be established, joint farming should become the dominant agricultural pattern in India, according to Mr. S. K. Dey, Union Minister for Community Development and Co-operation.

Addressing a press conference at the end of the three-day State Co-operation Ministers' Conference held in Srinagar, Mr. Dey said that the decisions of the conference on the establishment of some 3,000 experimental co-operative farms would be examined by the Government of India in the course of the next two months.

All states in the country had accepted the idea of co-operative farming, he said, and as the country had agreed on this programme, the Administration would be geared to face whatever difficulties might arise in establishing it.

The conference recommended that top priority should be given to increasing agricultural production; the co-operative movement, which had so far benefited mainly the richer sections of the community, needed to concentrate on improving the conditions of the weaker sections of the community. It was recommended that the Government should participate in co-operative activities, but should not dominate the movement and that there should be an elaborate programme of training and education of officials and non-officials in the principles of co-operation during the Third Plan period.

U.S.A.—

Society for Economic Botany

The newly constituted Society for Economic Botany is not an organisation composed merely of botanists, for it embraces many established disciplines — agronomy, anthropology, archaeology, chemistry, chemurgy, economics, ethnology, forestry, geography, geology, horticulture, medicine, microbiology, pharmacognosy, pharmacology, in addition to the botanical sciences. The Society is intended to bridge the gaps between various fields of science and improve the channels of communication.

The Society was established principally through the work of Dr. C. O. Erlanson, Chief, New Crops Research Branch, U.S.D.A.

The first annual meeting of the Society was held in May at the Purdue Memorial Union, Purdue University, Lafayette, Indiana, when more than 20 papers were given by outstanding experts in botany and the related sciences. The presidential address was delivered by Dr. Ernest Guenther, Vice-President and Technical Director, Fritzsche Brothers Inc., New York. Dr. Quentin Jones, Botanist of the U.S.D.A., Agricultural Research Service, Beltsville, Maryland, was elected first secretary.

Left: *Main growths of a typical hill sward of the wetter type—purple moor grass,* Molinia caerulea; *soft rush,* Juncus spp., *moor mat grass,* Nardus stricta. Right: *The kind of sward to be obtained by chemical renovation and oversowing—sheep's fescue;* Festuca ovina; *perennial ryegrass,* Lolium perenne; *red fescue,* Festuca rubra, *and white clover*

The techniques of chemical renovation of pastures which have been successfully employed on New Zealand's hill country were the subject of a conference held recently at Dumfries, Scotland, under the chairmanship of Mr. Michael Noble, M.P.

THE procedures involved in the chemical renovation of old pastures include the use of dalapon* for the destruction of the old sward without ploughing; or at lower rates of application for the suppression of undesirable species before oversowing with seeds of more productive grasses and clovers. Occasionally light cultivation, such as harrowing, disking or even the use of a rotary cultivator to a shallow depth, may be employed where it is necessary to penetrate a thick mat of dead herbage. As in any improvement programme, adequate drainage and the use of lime and fertiliser are necessary to create conditions suitable for the establishment of more productive pasture species.

During the last two or three years the Hill Farming Research Organisation and several of the Scottish agricultural colleges, notably the West of Scotland College, have carried out extensive trials on the above techniques all over Scotland with considerable success. Research workers and officers of the National Agricultural Advisory Service of England have similar investigations in progress.

Under hill farming conditions in Great Britain chemical pasture renovation can have considerable value. In Scotland it is not an uncommon thing to find a very considerable area of open hill, perhaps rising to 4,000 ft. and running to perhaps 25,000 acres, with only 70-100 acres or perhaps 1-10% of improved and fenced land near the farmhouse where sheep can be wintered or lambs fattened.

Hill farmers, lacking wintering ground, have been compelled to send away to warmer and kinder wintering grounds every year some scores of ewe hoggs at a cost of 35*s.* per head. Obviously, therefore, if the area of 'inbye land' can be extended by the chemical treatment of areas which are inaccessible to machines, or otherwise difficult to cultivate, the system could have very considerable value.

In addition, the conversion of *Molinia-Nardus* hill swards into something more productive would tend to spread the grazing of stock more evenly over extensive hill areas and relieve the concentration of sheep on better patches, which previously led to the advanced deterioration of hill swards generally and has often tended also to produce dense worm infestation of such heavily grazed areas.

In opening the conference, **Mr. Michael Noble, M.P.,** who farms 28,000 acres of hill land in Argyllshire, said that with the use of the new techniques there was now a chance of a big break through in our understanding of the best ways of improving hill farms.

Dr. R. F. Hunter (*Hill Farming Research Organisation*) said he believed there was a strong case for the use of dalapon in hill pasture management. This chemical at low rates could bring about a satisfactory kill or suppression of undesirable grass species and if mineral deficiencies were corrected, conditions would be right for oversowing with new grasses and clovers.

He felt the cheapest and most useful way in which dalapon could be used to improve or change a plant community was to apply 5 lb. per acre to suppress *Nardus* and *Molinia* species where they were accompanied in plant communities by more useful species. Swards should be limed and slagged before spraying and five weeks later wild white clover could be oversown.

Dr. Hunter did not favour surface cultivations under genuine hill conditions and said the best time for

* Sold under the trade name of 'Dowpon'.

spraying would be July-August on East of Scotland hills, with oversowing the following spring.

'I believe that grass herbicides, used intelligently and with a deep knowledge of the nature of hill grazing, will prove an invaluable tool in the general improvement of our upland pastures', Dr. Hunter concluded.

Mr. Andrew L. Gardner (*West of Scotland College*), who has carried out extensive trials in pasture renovation, said that chemical spraying can make all the difference between success and failure where an oversowing technique without cultivation is adopted. Where there was a dense grass cover, oversowing without chemical treatment failed, as the seeds had little or no chance of ever reaching the ground. Dalapon could kill or suppress this grass cover, thus giving the introduced seeds a chance to become established.

The cost of dalapon spraying varied between 30*s* and £5, depending on the degree of kill wanted. On hill farms starved of good early grass the value could be quite considerable and if sufficient land was improved to allow home wintering of ewe hoggets the profitability would not be in doubt.

'I believe that by chemical treatment areas of land difficult, impossible or inadvisable to tackle by conventional methods can be reseeded', he said, 'and, although not all swards lend themselves to this technique, results already achieved show that it has a wide application and merits the attention of all interested in grassland improvement'.

He gave two examples of the 'take' of oversown seeds measured a year after sowing. In the first the soil was thin peat with a mixed herbage and in the second it was of a gravelly nature, with an *Agrostis* fescue sward. Each area was given 2 tons of ground limestone and 2 tons of slag, but no cultivation, and stock were allowed free access.

Generally speaking, as the rate of dalapon increased, so did the percentage establishment of ryegrass and clover sown (see Table 1).

Mr. I. V. Hunt (*West of Scotland College*) put forward some original ideas on the quantities of lime needed as pre-treatment to the establishment of seeds where improvement was sought on hill swards with a high acidity. He suggested that the optimum lime requirement as assessed by the chemist could be considerably reduced on hill pastures, bearing in mind the shallow depth of soil on many hills and the fact that many quite satisfactory pasture species for hill conditions will thrive at a lower *p*H than would be desirable under a top-grade lowland fattening pasture. He also pointed out that the application of large quantities of limestone might well lead to trace element deficiency problems. Mr. Hunt suggested that as little as 1-4 cwt. of lime per acre would considerably benefit a hill pasture.

'The biggest difficulty in hill farm improvement is transport, and aeroplanes, helicopters and hovercraft all have a part to play. If aeroplanes can profitably be used in New Zealand to sow superphosphates at 2-3 cwt. per acre, to sow clover seed, to drop fencing materials, for rabbit control and for distributing trace elements, the same can be done in Britain.'

In peat areas, the dense mat of decaying vegetation has for many years been a barrier to seed establishment. This problem also arises where herbicides have been used on a dense sward mat.

Dr. Hunter reported that burning was not particularly successful.

Mr. James Cuthbertson† (*engineer-designer*) mentioned that he had recently developed a prototype machine for this work. It was a development of the 'Rotoflail', originally designed for chopping up the straw behind a combine harvester. Because the flails of this machine revolve in a vertical plane, it is possible for it to work unhindered by irregularities in the ground, and the depth of activity can be easily controlled. The knives are capable of chopping the herbage so finely that it is blown away by the wind, leaving an open sward in which the seeds can germinate.

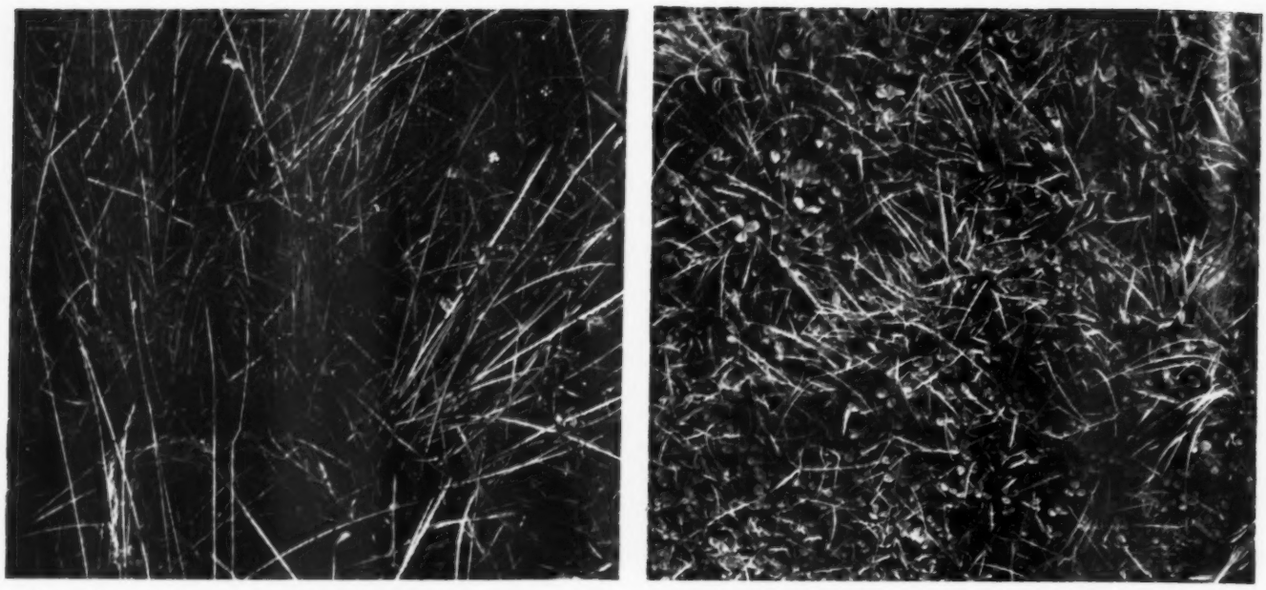
A lush sward of ryegrass and clover growing on an experimental plot laid down by the West of Scotland College, Ayrshire. It is 900 ft. above sea level and the soil is peat 1 ft. deep, growing normally Nardus Molina. *It was ploughed years ago and the sward then established was killed by 'Dowpon' this year before oversowing*

Table 1

Percentage establishment of pasture seed

		'Dowpon' applied per acre			
		0 *lb.*	2½ *lb.*	5 *lb.*	10 *lb.*
Plot A:	Ryegrass	2.4%	11.6%	26.0%	33.6%
	White clover	2.6%	3.2%	0.8%	3.6%
Plot B:	Ryegrass	9.2%	22.8%	30.8%	40.0%
	White clover	0.4%	0.4%	1.2%	5.2%

† See World Crops, 1959, 11, 177.



Left: *Close-up of an old sward at Brigidale Farm, Bute—long, tough, unpalatable and devoid of clover. The stocking rate is necessarily very low on land like this.* Right: *This new sward was obtained by lime and slag applied November 1958, a spray of 'Dowpon' to kill the old sward in April 1959, and a seeds mixture broadcast in the following June*

Illustrations Dow Agrochemicals Ltd

Mr. Cuthbertson said he has used his machine on 120 acres for reducing 3 ft. of herbage down to within 1½ in. of the ground. Hauled by a tractor, the machine can cover 20 acres a day at a cost of £1 per acre, deal with all tussocks and ant hills, and succeed in producing a reasonably level surface.

Technical News

In the handling of milk, cleanliness comes next to godliness, for milk can be poison if it is not hygienically handled. The attention of dairy farmers, particularly those living in hot climates, is drawn to the series of articles on the subject of 'Practical Cleaning Routines for the Dairy' which are appearing in *Dairy Engineering*.

Countries producing cereal crops usually have to manufacture biscuits to deal with their crop surpluses. The progressive automation of biscuit manufacture is described in the September issue of *Automation*.

Food Manufacture in this issue contains a review of new packaging materials which is important to those engaged in retailing agricultural and horticultural products.

In the September issue of *Fibres and Plastics* there is a review of the plant and equipment for air conditioning, often a major problem in the processing and storage of raw materials.

Specimen copies of the above journals are available on application to Leonard Hill House, Eden Street, London, N.W.1.

NOTE FOR CONTRIBUTORS AND AUTHORS

The editor welcomes authoritative articles and news items on agricultural machinery and agricultural methods, agricultural crops and new developments.

A short synopsis should preferably be included to assist the editor and the manuscript itself should be typed in double spacing with plenty of margin and on one side of paper only.

It should bear the name and address of the author and be accompanied by sharp photographs or line drawings with suitable captions.

Pests and Diseases of Strawberry

Research in progress on the virus diseases of strawberry and their methods of spread were reviewed last Members' Day by A. F. Posnette, of East Malling Research Station. Recent research has shown that these viruses are spread not only by aphids and leafhoppers, but also by eelworms. J. R. Chiswell and R. S. Pitcher gave further details of the leafhoppers and eelworms concerned and described how they spread the viruses from infected weeds. The life history and methods of control of the raspberry beetle and the strawberry seed beetle were discussed by G. H. L. Dicker and J. B. Briggs.

Manipulating Mites

An adult mite weighs only about one forty-thousandth of a gramme, so it is obviously a difficult matter to isolate and treat one at a time.

It has just been announced that the Plant Diseases Division of the D.S.I.R.O. in Wellington, N.Z., has developed a new technique and can now handle red spider mites individually. Thus it is now possible to determine the lethal dose for one mite and compare exactly the effectiveness of different pesticides and the resistance of individual strains.

One important conclusion already reached is that the lethal dose is a function of the humidity. With high humidity, the fatal dose is one two-thousandth of that required under conditions of low humidity.

Looking for a New Insecticide

D. SAGGERS, B.SC.*

This short account of the laboratory methods used in the search for new insecticides brings out the difference between a contact poison, a fumigant and a stomach poison.

INSECTICIDES are used for the protection of man, his crops and his animals against insect pests when cultural or biological methods are inadequate or too slow to give prompt relief. The early insecticides were mainly inorganic poisons or materials of plant origin developed by the initiative of scientifically-minded individuals to meet their own particular problems.

Although often effective, the considerable agricultural expansion during the inter-war years has emphasised their limitations rather than their usefulness. In addition, the constant use of some of the more common inorganic materials over a considerable period has led to the development of resistant strains which are no longer controlled by economic dosages.

Consequently, by the end of the thirties, there was a considerable demand for efficient, wide-spectrum insecticides which were cheap and safe to handle. This demand was partially met by the discovery of DDT in 1939 by Geigy and its subsequent rapid wartime exploitation. Since then a large number of synthetic insecticides with varying ranges of activity have been developed and today the insect poisons discovered number hundreds. However, only a small proportion of these can be marketed and the search for better insecticides still continues.

Three methods of search

There are several ways in which this search for new insecticides can be carried out. The first and most direct way is to prepare a large number of materials related to a known insecticide in the hope that one of them may be better than the parent, possessing a higher insecticidal action, a lower phytotoxicity or reduced mammalian toxicity. A second method is to investigate the vital biochemical or physiological processes of the insect and to devise a specific poison for one of them. A third, and probably the most widely used, is to examine as many different chemicals as possible in the hope that one will show some activity which can be exploited directly or further developed.

Since the number of candidate compounds produced by a chemical company actively engaged in the search for new insecticides may run into hundreds or even thousands per year, it is obviously not practical to test each new material in the field.

This would involve the chemist in a great deal of work, for even a small-scale field test requires a comparatively large quantity of chemical. On the other hand, the field entomologist would be carrying out tests on chemicals which in 99% of the tests would probably be ineffective anyway. The testing would also be very seasonal; months might elapse between the synthesis of a new chemical and obtaining the results of its performance, a particularly frustrating state of affairs for the chemist. In addition, the close co-operation of the pests would also be

* Chesterford Park Research Station, Essex.

Left: *Spraying aphids in the laboratory to measure contact action.* Right: *Treating individual insects with a single drop of insecticide to measure contact action*

Insectary used for the continuous rearing of experimental insects

required, and, as most entomologists know, they are most unreliable.

The most efficient method

For these reasons the most efficient selection process, where a large number of compounds is involved, consists of a preliminary laboratory evaluation designed to eliminate useless materials, followed by field trials with only those compounds which have shown promise in the laboratory. The laboratory trials may be carried out against the actual pest species which it is desired to control or against a wide range of 'representative species'.

The first method has the advantage of giving a direct answer to a specific problem. On the other hand, it is possible that what could be a perfect acaricide might be rejected and forgotten because it had failed to kill locusts. The second method, although not providing a direct answer, does indicate the full potential of the compound and suggests lines of most promising exploitation.

The 'representative' insects chosen by various laboratories depends upon the facilities available and the degree of risk or omission accepted in the interest of testing a large number of materials. In general, however, the systems tend to include an aphid, a caterpillar, a spider mite, a fly and a beetle. The species of each is usually determined by such factors as ease in rearing, in handling during the experiments, and in availability of food.

Many economic pests are unsuitable test species, since their food cannot always be obtained continually through the year, whilst others have such complex or lengthy life cycles that they would require too great a share of the expensive laboratory space to rear them. For this reason most of the insect species used in the first-stage tests tend to be rather insects of convenience than of economic importance.

Three methods of attack

In devising methods of investigation due regard must be paid to the methods by which an insecticide attacks the insect. The techniques adopted must be as foolproof as possible to cover all practical eventualities if nothing important is to be missed. In general, an insecticide can be considered to enter the insect by three main routes:

(*a*) Through the skin, feet or egg wall.
(*b*) Through the breathing pores.
(*c*) Through the gut.

Depending on such factors as the physical properties of the material, the structure and behaviour of the insect, one or other of these routes will be especially favoured. According to which is effective, the insecticide is classified as a contact, a fumigant or a stomach poison.

When testing a chemical for the first time the main object is to achieve the maximum insecticidal response. This is a particularly important consideration with completely unknown compounds, when even the slightest effect may be an important clue and a further simple chemical change may enhance the activity considerably. Thus, in the first tests, the dice are deliberately loaded very heavily in favour of the chemical. Experimentally, this can best be achieved by arranging that all main routes into the insect are attacked simultaneously.

In the case of the aphid, for example, the insects are sprayed with the chemical while they are feeding on the plants and the whole enclosed in a small glass cage. The treated insects are then left to breathe the fumes, to wallow in and feed on the deposit for about 24 hours, after which the kill is estimated. Similarly, caterpillars may be placed in small enclosed glass dishes to feed on cabbage leaves liberally dosed with

An electric fence system used to confine wingless insects to chemically-treated plants in stomach poisoning tests

a dust of the chemical for a period which is long enough for even a very slow-acting material to show some effect.

Four questions

If the compound fails to give any kill of one of the test species in this first crude gross activity test, then it is reasonably certain that it will have little commercial value. If a kill is obtained, the next questions to be asked are: How did the chemical penetrate? By contact, fumigant or stomach routes? What is the minimum effective dose? How long will the chemical persist?

The question of the route is best answered by devising tests which allow only one factor to act at a time. A simple method of measuring contact action is to treat the insect by placing measured drops of the chemical dissolved in a volatile solvent on its skin. The drop is placed in such a position that the insect cannot ingest it, nor is it large enough to penetrate the breathing pores. A cruder, but quicker, technique is merely to spray the insects and place them on untreated food.

Fumigation activity can be quickly measured by placing the chemical and the insect together in a small enclosed space with a filter between them for a period of 48 hours. The fumes of the insecticide are able to reach the insect without the latter touching the chemical.

To measure pure stomach-poisoning action is a laborious procedure, since it involves feeding the chemical to the insect in such a way that only the mouth parts contact the chemical and there is no inhalation of vapour. Normally, a compromise has to be accepted whereby the food of the insect is treated and the insect is allowed to feed in the normal manner. In the laboratory, however, even this simple procedure is fraught with difficulties if a realistic result is required. During the tests it is obviously important for each group of insects to be confined to its own particular treated plant to avoid confusion between treatments.

The most simple way of doing this is, of course, to enclose them in a glass cage. If this is done, however, the insecticide fumes build up within the cage and give an over-optimistic impression of the activity of the compound. To overcome this difficulty

Photos: Fisons Pest Control Ltd.

Examining chemically-treated leaf disks for dead spider mites

the entomologist has taken a leaf from the farmer's book in that he uses an electric fence. The fence is somewhat more delicate than that required to keep cows in a pasture, but the principle is the same. A high-frequency low-voltage current is applied to a series of electric fences around each chemically treated plant.

It goes without saying that the insects used are wingless forms which can only move by crawling.

Using these fences, it is quite a simple matter to confine insect populations on different chemical treatments in the close confines of the laboratory and at the same time obtain a result of both theoretical and practical use. To obtain a measure of the persistency of the treatments the plants are re-infested with fresh populations of insects at regular intervals until no further kill is observed.

When all this preliminary work with the chemical has been carried out—with the contact, fumigant and stomach-poisoning action measured against the range of representative species—a reasonable appreciation of the insecticidal potentialities of the chemical is possible. If it is promising, then the far more complex problem of field development begins. At this stage such factors as toxicity to mammals, ease of formulation, storage properties, production methods and costs relative to market potentials have to be considered. It is therefore little wonder that probably less than 1 in 100 even of the compounds which have shown promise at the laboratory stage ever receive a trade name.

Aid to Ceylon

The Canadian Secretary of State for External Affairs, Mr. Howard Green, has announced that agreement had been reached concerning the use to be made of $2 million that will be provided under Canada's 1959-60 Colombo Plan Capital Assistance Programme for Ceylon and $1,290,000 which is part of the 1958-59 programme.

These funds, totalling $3,290,000 will be used to provide commodities, equipment and services requested by the Government of Ceylon to help it carry forward its economic development plan. These include $1 million to provide flour to assist in meeting Ceylon's food requirements and $600,000 to continue an aerial survey of Ceylon's natural resources.

Coming Events

Forestry.—The 5th World Forestry Congress takes place from 29 August-10 September, 1960, in Seattle. Details may be obtained from Dr. I. T. Haig, Executive Secretary, 5th World Forestry Congress, c/o Office of International Conferences, Department of State, Washington 25, D.C., U.S.A.

Food. — The British Association for the Advancement of Science will hold its annual meeting in Cardiff, Glamorganshire, from 31 August-7 September. Of particular interest is the Symposium on World Food and Population, which will be held on Monday, 5 September. The principal speakers will include Dr. N. C. Wright, Deputy Director-General of FAO; Prof. D. V. Glass, Professor of Sociology in the University of London; Prof. W. A. Lewis, Principal, University College of the West Indies; Dr. L. Dudley Stamp, Director, Land Utilisation Survey of Great Britain; Sir Alexander Fleck, Past President of the Association; Dr. H. D. Kay, Professor Emeritus, University of Reading; Prof. P. M. S. Blackett, Professor of Physics, Imperial College of Science and Technology. Copies of the preliminary programme may be obtained free of charge from the Secretary, British Association, 18 Adam Street, Adelphi, London, W.C.2.

Rubber Research.—An International Conference on Natural Rubber Research, sponsored by the Rubber Research Institute of Malaya, with the support of the Government of the Federation of Malaya and the Rubber Producers' Council, will take place in Kuala Lumpur from 26 September–1 October, 1960. Further information may be obtained from the Rubber Research Institute of Malaya, P.O. Box 150, Kuala Lumpur.

Agricultural Chemicals.—The Surface Activity Group of the Society of Chemical Industry is holding an International Symposium on Powders in Industry on 29 and 30 September at the Royal Institution, London. Preliminary programme and further information may be obtained from the Hon. Secretary of the Surface Activity Group, Society of Chemical Industry, 14 Belgrave Square, London, S.W.1.

Organisers of meetings, conferences and agricultural exhibitions are invited to supply information for this regular feature. This should be received by the Editor at least three months prior to the event.

Timber. — The 2nd International Timber Fair will be held at Basle from 1-9 October. Details from Mr. Paul Hagi, c/o Spoerri & Co. A.G., Schaffhauserstrasse 89, Zurich, Switzerland.

Oils and Oilseeds.—A conference covering the production, processing, chemistry and utilisation of vegetable oils and fats is to be held from 13-16 October at Bari, Italy. Further information can be obtained from Dott. Eng. Borelli, Secretary of the Organising Committee, Borsa Merci di Bari, Corso Cavour 2, Bari, Italy.

Water.—A conference covering irrigation, drainage and water conservation, under the chairmanship of Mr. W. T. Price, Principal of the Harper Adams Agricultural College, is to be held at Cambridge on 18 October. Further details from Farm Intelligence Ltd., 42 Parliament Street, London, S.W.1.

Weed Control.—The 5th British Weed Control Conference will be held in Brighton from 7-10 November. The main session will cover the following subjects: Impact of Herbicides on Crop Husbandry; Weed Control in Arable Crops; Improvement on Pastures and Hill Grazing—Bracken Control; Problems of Advice and Education; Weed Control in Horticultural Crops; New Herbicides; Weeds of Waterways; New Techniques in Agriculture and Horticulture; Translocation and Fate of Herbicides in Plants. Information and registration forms from the Secretary, British Weed Control Conference, 52 Bedford Row, London, W.C.1.

Corrosion and Metal Finishing.—The 1960 Exhibition will take place at Olympia, London, from Tuesday, 29 November, to Friday, 2 December.

Bookings are now being accepted and full information is available from the Organiser, *Corrosion Technology*, Leonard Hill House, Eden Street, London, N.W.1.

Agricultural Exhibitions

Germany.—An Agricultural Exhibition is to be held at Saarbrucken from 23 April-21 October. Further information from Ausstellungstechnische Leitung und Organisation Stadtverwaltung, Saarbrucken.

The National Agricultural Show takes place in Stuttgart from 24 September-2 October. Information from Stuttgarter Ausstellungs G.m.b.H., Am Kochenhof 16, Stuttgart-N.

Australia.—The Royal Agricultural Show is to be held in Perth from 30 September-6 October. Particulars from the Royal Agricultural Society, 239 Adelaide Terrace, Perth.

U.S.A.—The 8th annual Farm Progress Show will be held near Joliet in Will County, Illinois, from 21-23 September. Further information from the Organiser, Farm Progress Show, Prairie Farmer Publishing Co., 1230 Washington Boulevard, Chicago, Illinois.

Switzerland.—The 'Olma' Agricultural and Dairy Show will be held at St. Gall, Switzerland, from 13-23 October. Further information from the Swiss Legation, Commercial Section, 18 Montagu Place, London, W.1.

Canada.—The Royal Agricultural Winter Fair will take place in Toronto from 11-19 November. Details from J. R. Johnson, Royal Coliseum Exhibition Park, Toronto 28.

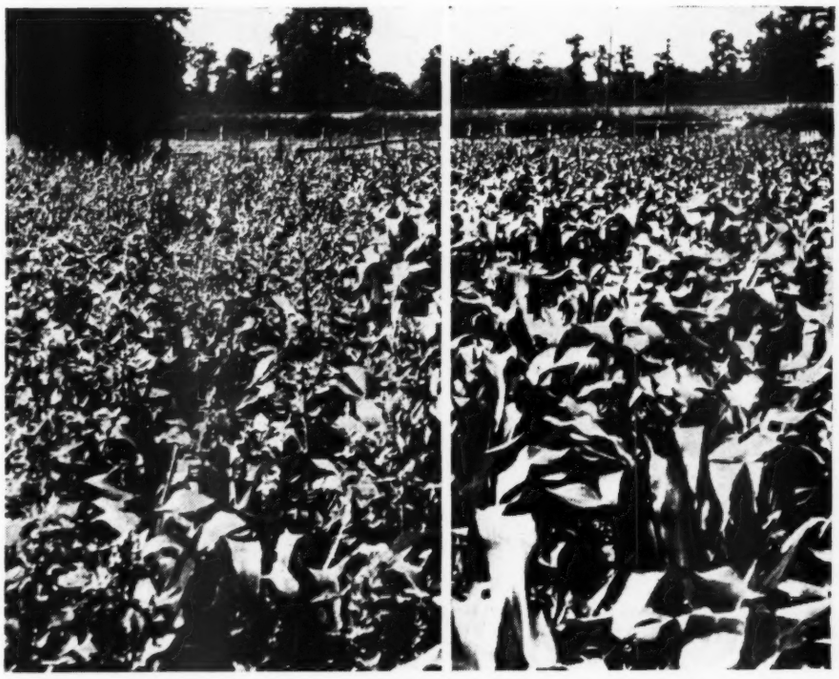
England.—The Smithfield Show and Agricultural Machinery Exhibition will be held at Earls Court, London, from 5-9 December. Particulars may be obtained from Smithfield Show Joint Committee, Forbes House, Halkin Street, London, S.W.1.

Weed Control in Maize

M. EDDOWES*

WITH the development of early-maturing, high-yielding varieties of hybrid maize, both in the U.S.A. and on the Continent, and of efficient methods of mechanically harvesting and handling the crop, new interest has been stimulated in the possibilities of growing maize for silage, the crop being capable of producing a high yield of nutritious and palatable fodder.

One serious problem with this crop is weed control, for competition from weeds for water, nutrients, light and space can severely check the growth of the crop in the early phase of its establishment. Weed control by cultivation is time-consuming and expensive and may result in damage to the spreading fibrous root systems of the crop. Effective chemical weed control offers better prospects for growing this crop at low cost.



Maize (left) *unsprayed, infested with fat hen.* Right: *Sprayed with simazin*

Weed control trials

To investigate the problem of weed control a trial was laid down in 1959 at Harper Adams College in conjunction with Fisons Pest Control Ltd. In one part of the maize field, observation plots, each 60 ft. x 15 ft., were treated with (*a*) atrazine and (*b*) simazin pre-emergence sprays five days after drilling the maize. The rates of application were 1, 1½ and 2 lb. of active ingredient in about 35 gal. of water per acre, with control plots alongside. A further area of 1 acre was treated with simazin at 1½ lb. per acre in the same volume of water.

The main area of the crop, consisting of about 11 acres, was sprayed with MCPA at the rate of 20 oz. active ingredient in 10 gal. of water per acre in two stages: 7 acres was sprayed at the five-leaf stage on 19 June, when the plants were 6-9 in. tall; the remainder was treated on 4 July, when the plants were 12-15 in. tall. Both sprayings were carried out under very favourable weather conditions.

Table 1

Comparative results with pre-emergence spraying

Species	*Atrazine*	*Simazin*
Fat hen	S	S
Charlock	S	S
Chickweed	S	S
Mayweed	S	S
Annual meadow grass	S	S
Field pansy	S	S
Fumitory	MS	MS
Speedwell	MS	MS
Orache	MR	MS-MR
Red shank	MR-R	MR-R
Field bindweed	MR-R	MR-R
Catmint	MR-R	MR-R
Couch	MS-MR	MR-R
Field vetch	MR	MR
Knotgrass	R	R
Creeping thistle	R	R
Docks	R	R
Potato	—	R

Application rates: 1-2 lb. active ingredient per acre

Summary of results

Pre-emergence weedkillers atrazine and simazin were compared with a standard MCPA preparation and all gave satisfactory weed control.

The major annual weed species, fat hen, spurrey, mayweed, chickweed and annual meadow grass, were effectively controlled by the pre-emergence sprays, but perennial weeds were largely resistant. Atrazine is more soluble than simazin and is likely to be more effective in the drier districts.

Under favourable conditions MCPA used post-emergently gave more complete control of the weeds within its range than did the pre-emergence sprays.

The advantages and disadvantages

*Harper Adams Agricultural College

of these materials are summarised as follows:

Atrazine and simazin

For: (1) Adequate control of annual weeds. (2) Very effective under wet conditions.

Against: (1) Relatively high cost, £4-£6 per acre. (2) Little effect on perennial weeds. (3) Possible residual effect on following crop (still being investigated).

MCPA

For: (1) Low cost, 12*s*.-15*s*. per acre. (2) Excellent weed control within its range.

Against: (1) Many important annual weeds are resistant. (2) Warm and dry conditions are needed for good results. (3) Damage to leaves and prop roots may check the growth of the crop and render it liable to lodge.

An indication of the reaction of various species to atrazine and simazin is given in Table 1, where S = susceptible, MS = moderately susceptible, MR = moderately resistant, R = resistant.

In general, the higher the application rate the greater the weed control achieved. Atrazine being more soluble, and hence more mobile in the soil, is likely to give better results in lower rainfall areas, and against the shallow-rooted perennials, couch and water grass. Even in a very damp weedy section of the field, simazin had little effect in the absence of rain.

Observations suggest that spraying the crop with MCPA when it is 4-6 in. tall will result in most effective weed control and a minimum of damage to the crop itself.

[This is an abridged version of *Tech. Bull. M.2 H.A.A.C.* issued in November 1959.]

Weed Research

The Agricultural Research Council of the U.K. is setting up a new Weed Research Organisation, which will assume some of the present functions of the Council's Unit of Experimental Agronomy at Oxford University. This has been created for the purpose of extending the applied research which lies between the basic scientific investigations being carried out by the A.R.C. Unit and the introduction of new methods of weed control in agriculture and horticulture.

The Council has acquired a farm near Oxford, where a laboratory and other buildings are to be provided.

The Director of the new Organisation will be Dr. E. K. Woodford, at present Assistant Director under Prof. G. E. Blackman, of the A.R.C. Unit of Experimental Agronomy.

Tea Planting in Argentina

A prosperous and expanding future for Argentina's young tea-growing industry, in which $15 million have been invested, is foreseen by the tea expert, Mr. J. F. Couwenberg—if modern techniques of growing and processing are adopted and the quality of the product is improved.

Mr. Couwenberg, a Hollander from Indonesia, has just completed an 18-month assignment for FAO to help the Government of Argentina to improve the efficiency of her tea industry.

Progress of the industry

A remarkable expansion in this industry took place a few years ago. In 1954 there were 7,000 ha. of tea plantations; a year later there were more than 30,000 ha. As it takes five or six years for a tea bush to grow from seed to readiness for the first picking, this boom planting is only now coming into production.

The industry is concentrated in the inland states of Misiones and Corrientes, on the borders of Paraguay, which was one of the first of the South American countries to grow tea about 50 years ago. The Argentine industry started only 35 years ago and less than 20 years ago the first tea factory replaced hand processing.

Quality essential

Present production amounts to about 4,500 tons, of which 2,000 tons are exported. According to Mr. Couwenberg, home consumption is only about 100 g. per head per year and it is reasonable to assume that this consumption may be doubled in 10 years when production is expected to reach at least 10,000 tons.

This would leave more than half to be exported and the only way the international market could be persuaded to buy more Argentinian tea would be to improve the quality of the product. Rising costs of production have already made the tea expensive in relation to its quality: labour costs have gone up 300% and plantation upkeep costs 400% in the past two years. If the Argentine industry is to meet the demand for higher quality teas, then all-round improvement in growing and processing practices must be introduced.

Low productivity

Both soil and climate in Argentina are excellent for tea growing and Mr. Couwenberg pointed out that there is probably no country where there is a greater rate of growth. But productivity is low in most of the gardens; they have only 3,000-4,000 bushes per ha., whereas they could have up to 10,000 or 12,000. Furthermore, the bushes are of mixed types, yielding big and small leaves of varying quality, while in the majority of the 200 factories the processing machinery and techniques are so unsatisfactory that much of the tea produced is of low quality and flavour.

Proposals for improvement

As part of the plan to improve growing and processing, Mr. Couwenberg helped the local agricultural Government agency to set up small experimental gardens and also a pilot plant for processing tea. He helped the growers by establishing a dry-tea sorting plant, with a capacity of 2,000 tons per year, for training growers and tea processors. He proposed also that the Government should assist the industry by setting up a central research institute to carry out varietal trials and research on tea processing.

Tea factories

One of the largest factories in Misiones—a seven-storied building—now produces 3 million lb. of tea a year and expects to increase its output to 6 million lb. in 1961.

A new factory—one of the most modern in the world—is being built at Monte Carlo in the State of Misiones and is to come into operation in the autumn. This is a joint venture between the local planters' co-operative and a Dutch company who will supply the machinery.

The Groundnut Industry of Queensland

L. T. SARDONE

Starting from small beginnings in 1934, groundnuts have become a crop of considerable economic importance to Australia.

Harvesting groundnuts on a Queensland farm

History

THE groundnut or peanut, *Arachis hypogoea*, is believed to have been cultivated by the Incas of Peru, South America, some 3,000 years ago. Magellan, in the 15th century, introduced it to the Dutch East Indies and today considerable quantities are produced in India, Africa, China, North and South America, Indonesia, Siam, the West Indies, New Guinea and Australia.

The industry did not come to Australia until 1924, when a few Queensland farmers became interested in its commercial possibilities. Subsequently they formed the Queensland Peanut Marketing Board to dispose of their crops, and today this Board also operates silos and processing machinery.

Each year the Board estimates the amount of each variety required for the Australian market, plans production for the coming season, and estimates the seed requirements of the individual growers.

Varieties

Considerable testing over the years has resulted in the acceptance of two varieties as the most suitable for Australian conditions. The best yield is obtained from 'Virginia Bunch'—1,700 lb. to the acre (maximum 3,000)—while the second variety, 'Red Spanish', yields around 1,100 lb. (maximum 2,200). For edible purposes the requirements are roughly 65-70% 'Virginia' and the remainder in 'Spanish'. The 'Valencia' and 'White Spanish' varieties are also produced, though in much smaller quantities.

Close-up of a groundnut plant showing the pods

The plant

The crop is an annual, which can easily be killed by frost. Moderate rainfall, abundance of sunlight and comparatively high temperatures are the essential requirements.

Its small yellow flowers are borne in the axils of the leaves. After pollination the flower stalk elongates, bends downward and carries the developing pod down into the soil. This flower stalk is commonly known as a peg, and the pod does not develop unless the peg penetrates the soil. The period of growth is from 16-22 weeks, according to variety, the district in which grown and the seasonal conditions during growth. The plant ultimately reaches a height of from 12-18 in.

Well-drained, open-textured soils, such as a sandy loam with a high

Feeding the crop into an Australian-made groundnut thresher delivering 60 bags an hour

humus content, are the most suitable. Satisfactory crops can be grown on a wide range of soils, but heavy clay soils which are inclined to become hard and compact should be avoided. These frequently produce large crops, but considerable losses occur when harvesting, particularly with varieties which readily shed the pod.

Crop rotation essential

The first crop on a suitable soil is usually particularly good, yields of as much as 2,500 lb. per acre being frequently obtained with 'Virginia Bunch'. Uninterrupted cropping, however, will reduce the yield to an uneconomic level and a rotation of crops is essential.

The climatic conditions are such that the main selections for the rotation are summer crops, but these are supplemented, where possible, by winter crops. Maize, grain sorghums, sweet sorghums, Sudan grass, white panicum and Japanese millet are all suitable. The residues from these must be ploughed in, and in the case of the more open soils a bulky fibrous crop, such as Sudan grass, should be included in the rotation and ploughed in as a green manure prior to planting groundnuts. Beneficial results have also been obtained by using Rhodes grass as a soil renovator by grassing over the areas for two or three years.

Seedbed preparation

A field comparatively free from weeds should be selected to reduce the need for weeding the growing crop and cultivation prior to planting should be thorough. If no cover crop is being grown during winter, first ploughing should be completed by the end of June (midwinter), and if the land is contour farmed this should be done across the slope of the land, which is then allowed to remain in this rough state until the spring.

On sloping land subject to erosion planting on the contour, combined with contour banks and/or strip cropping, should be adopted. Spring ploughing should then be followed by cultivation to produce a loose, fairly fine seedbed and to conserve soil moisture by keeping weed growth under control.

Nutrient requirements

Groundnuts make a heavy demand on the mineral nutrients in the soil, particularly calcium, phosphorus and potassium, though the crop does not usually respond to fertilisers as much as do some other crops. If fertiliser has been applied to the preceding crop in the rotation, it is usually not necessary to add any more for the groundnut crop.

In some areas superphosphate at 2-3 cwt. per acre has given beneficial results. On light-textured soils of low or moderate fertility a complete fertiliser mixture, containing a high percentage of phosphate and a low percentage of nitrogen, should be applied at, say, 3 cwt. per acre, but only when the preceding crop has not been fertilised.

Fertiliser may be applied in the row before planting, but it should be covered by a layer of soil, so that it does not come in contact with the seed, thereby impairing germination. With red volcanic loam, intimate contact between fertiliser and soil is liable to render the phosphate non-available to the plant. In this case the practice of applying the fertiliser in a narrow band and covering it with a layer of soil is better than working it into the soil.

Cause of unfilled shells

Calcium in the soil must be high for satisfactory yields and with the large type, 'Virginia Bunch', a high percentage of unfilled shells or 'pop' in the harvested crop usually indicates a deficiency. The amount of available calcium in the fruiting (or pegging) zone has a marked influence on kernel development.

Where 'pops' occur the soil should either be limed or treated with a relatively soluble source of calcium, such as gypsum or calcium sulphate, which should be applied to the foliage at the early flowering stage, using about 3 cwt. per acre. When lime is used, 10-15 cwt. per acre should be broadcast three or four weeks prior to planting; higher rates are required where the soil is very acid. However, the soil should be maintained in a slight to moderately acid state for optimum growth and the excessive use of lime must be avoided.

Seed selection and treatment

The growers are required to purchase their seed from the Board and this seed is carefully selected and stored in silos separately from trade stocks. After deshelling the nuts and grading the kernels a representative sample from

each batch of 35 bags is subjected to a germination test and only those lots which pass the required minimum of 80% viability are sold as seed.

The seed is treated with a fungicidal dressing, applied to the kernels at the rate of 1 oz. per 20 lb. of seed, using a Hannaford seed pickler.

Sorting groundnuts on an inspection belt at the factory of the Peanut Marketing Board

Tests made during 1957 and 1958 have indicated that, whilst the mercurial seed dressing previously used gave good control of pre-emergence rots, it was not effective against crown rot, a serious disease which causes considerable losses during, and for some weeks after, emergence. In 1958 a new seed dressing was introduced, consisting of a mixture of a mercurial with captan, and this has proved extremely effective against the crown rot mould.

Planting systems

The planting season is from October to January (*i.e.* early summer). Planters and maize drills fitted with special groundnut plates are used and the seed is sown at a depth of from 2-3 in.

A width of 36 in. between rows and a plant spacing of from 10-15 in. is recommended for 'Virginia Bunch', equivalent to approximately 30 lb. of seed per acre. For 'Red Spanish' a width of from 30-36 in. between rows is advised, with a plant spacing of from 6-10 in. 'Red Spanish' kernels are smaller and about 25 lb. per acre is adequate even for this closer spacing.

Cultivation and weed control

During the first month after planting cultivation is done with special groundnut harrows or ordinary light lever harrows which are dragged across the rows after the plants appear. This early harrowing considerably reduces later hand work, since such cross-harrowing eradicates many weeds in the row.

The stand of young plants is not harmed if the surface is free of debris. Inter-row cultivation should be continued until the first pods begin to develop. At least one hand chipping will probably be necessary to ensure complete weed eradication. During the last cultivation a slight hilling is frequently given to provide an easy entrance for the fruiting pegs.

Hormone weedkillers are commonly used for the control of the very susceptible weeds, such as bellvine (ipomea and convolvulus), wild turnip and, to a limited extent, Nagoora burr, *Xanthium pungens*, which are the main weeds. The grasses urochloa, crows-foot and summer grass are also common, but no satisfactory chemical control measures have yet been found.

Harvesting methods

As the crop does not mature evenly, harvesting is done when most of the pods are ripe. Plants at this stage usually show a yellowing of the foliage, but an examination is still necessary before deciding to harvest.

At maturity the inside of the shell usually begins to colour, at least at one end, and shows darkened veins. With 'Virginia Bunch' a few early pods may be lost, but 'Red Spanish' usually retains its pods for a considerable period after maturity.

While manual labour is still required at harvesting, reasonably efficient pick-up threshing has been in operation over the past 10 years and indications are that all harvesting operations will ultimately be mechanised.

The Eckart-Victory groundnut harvester, which will pull two rows and divert the lifted plants to form a single central windrow, from which they may be hand sorted and stooked, is now on the market. It is a tractor-mounted machine which will deal with 25 acres a day.

With manual harvesting the tap root is usually cut with specially designed cutting blades adjusted to cut just below the level of the peanuts in the soil. A slight tilt of the cutting blades loosens the soil around the plants and facilitates pulling.

Cutters may also be mounted in pairs on tractors, while small areas may be cut by single cutters attached to horse-drawn cultivators.

After under-cutting, the plants are pulled by hand and placed in bundles of a convenient size for handling when

A crop of 20,000 tons of groundnuts stacked in the open under tarpaulins

stooking, the soil being shaken from the plants at the same time.

Stooking

Plants stooked without support are gathered from eight to 12 rows and placed in a single line, the average stook being about 36 in. in diameter and 42 in. high.

Dry weather is essential for the first week after pulling to allow the plants to dry, but after this rain damage is of little importance, providing the wet weather is not prolonged.

Unfavourable harvesting weather produces a darkening of the pods and moulds may develop, causing a deterioration in quality; they may even destroy a large proportion of the crop.

Threshing

Plants may remain in stooks for from 14-28 days, depending on the weather conditions. The plants must be dry and the pods must shatter easily from the pegs before threshing is attempted. Threshing is usually done by contractors, using machines of Australian manufacture.

Stooks are generally conveyed on low wagons to the thresher, which is moved from time to time to convenient field positions. The plant residues, after the removal of pods, are subsequently used as fodder.

Processing and marketing

Providing the groundnuts are dry, mature and of sound merchantable quality, they are accepted by the Board, the maximum allowable moisture content being approximately 12%. An advance payment based on the grade is the normal procedure and the succeeding payments depend on the subsequent realisations.

The storage silos of the Peanut Marketing Board of Queensland

The produce may be sold by the Board in the shell or as raw, roasted, blanched or salted kernels. The kernels are also used in confectionery and for making peanut butter.

Reject kernels are pressed to obtain groundnut oil, which is used domestically, for food processing and for the manufacture of margarine. The residual cake is a high-protein stock food.

The first crop handled by the Board in 1924 amounted only to 231 tons, valued at £A10,650. Since then the industry has progressed and the 1959 crop is estimated to be some 34,000 tons, worth about £A3½ million. This crop was produced on some 60,000 acres by 1,693 growers, the overall yield being 1,269 lb. per acre.

The industry is now soundly established as an important factor in the economy of Australia.

Disease of Cacao

According to *Cacao*, an official publication of the Inter-American Institute of Agricultural Sciences in Costa Rica, *Phytophthora palmivora* continues to be highly destructive and the most widespread disease of cacao in Latin America.

It has been shown previously that Bordeaux mixture applied in high volume was invariably better than other fungicides tried. Nevertheless, Bordeaux does not give complete control and appears to have some phytotoxic effect in burning young leaves and sometimes giving a crinkled and hardened appearance to older leaves.

The recent development of new organic fungicides effective against *Ph. infestans* may be of great importance. Preliminary reports indicate that these are less phytotoxic than Bordeaux mixture (no further details are given).

The best long-term method of control would undoubtedly be by the development of resistant types of cacao, for it is known that a wide range of susceptibility exists.

Action Against Rhinoceros Beetle

Swift, vigorous action has been taken by the Department of Agriculture in Fiji to stamp out the rhinoceros beetle on the island of Moturiki, where specimens were found breeding in a dead palm.

Fifty men sent to the island by the Coconut Pests and Diseases Board climbed many thousands of palms and sprayed the crowns with insecticide. At the same time, the people of Moturiki have made a thorough search of the island for breeding places. Compost heaps, rubbish dumps, dead palms, rotting logs and other likely breeding places have been destroyed.

Hitherto an intensive and costly control campaign had kept the pest confined to the main island of Viti Levu and prevented its spread to the islands of the group that are the home of Fiji's £3 million a year copra industry.

Cacao in Trinidad

G. W. SMITH, M.SC., A.INST.P.*

The cocoa of commerce is obtained from the seeds of the cacao tree, Theobroma cacao, *which is the botanical name given to it by Linnaeus meaning literally 'Food of the gods'. It is the third most important crop in Trinidad.*

Cacao pods growing on the tree

THE cocoa trees of Trinidad originally came from the hot, humid rain forests of the Amazon valley. It is a tree which can be grown on suitable soils within the parallels 25° north and south of the equator, though it does best within the 15th parallels, at elevations ranging from near sea level up to an elevation of about 2,000 ft.

Cacao requires a deep, well-watered and yet well-drained soil, protection from strong winds and a hot, humid climate. The mean annual temperature should be about 80°F, and a well-distributed annual rainfall of some 80 in. or more is essential, with no prolonged periods of drought.

The tree

The cultivated tree is generally of small stature, seldom exceeding 25 ft. in height. The leaves are large, smooth and glossy; they are thick, oblong and pointed and are found principally at the ends of the branches, though sometimes they grow directly out of the trunk of the tree. The flowers are small and occur in numerous clusters on the main branches and even on the trunk itself; the matured fruit appears to grow straight out of the wood, being directly attached to the branch by a short stalk.

Generally, only a single fruit reaches maturity from a cluster of flowers, and its colour varies from lime green to yellow, red and even deep purple. The vivid colours of the fruits and their appearance of being artificially attached to the tree are a striking feature of this interesting crop.

Propagation

The crop may be propagated either from seed or vegetatively, although today it is more usual to use cuttings taken from a selected parent tree. The Government is supplying over a million rooted cuttings a year and, in addition, many estates have a number of selected plants which they have recorded. One such estate produces some 18,000 plants each year in its nurseries.

In Trinidad, breeding and selection work has been chiefly concentrated on evolving strains of cacao resistant to witches' brown disease and those giving higher yields. The work of Dr. H. Evans, senior plant pathologist of the Cacao Research Scheme, has led to improvements in the methods of production of rooted cuttings.

A pod cut open to expose the mass of seeds and mucilage within

The technique now employed is to dip the selected cuttings in a rooting hormone and plant them in a prepared potting soil in small, close-woven baskets. The soil consists of a mixture of rich loam, sand and rotten coconut fibre. Baskets are used instead of pots, because there is then no need to remove the plant when it is ready for transplanting; instead the seedling is planted in the field together with its basket, which in due course rots away. In this way root damage is avoided.

Great care is required in raising

* Imperial College of Tropical Agriculture, Trinidad.

Cacao beans taken from the sweat box in a half-fermented state

these seedlings, as the young plants are very delicate. They are first kept in dense shade and in an atmosphere of 100% humidity, and then, after they have rooted, they are hardened-off by gradually increasing exposure to normal atmospheric conditions of air and light. Five years after they have been planted out in the field they should be in bearing.

Its fruit

The ripe fruit of the mature tree is an elliptical ovoid from 7-10 in. in length and from 3-5 in. in diameter. It has a hard, leathery rind with 10 longitudinal ribs. The inside of the pod has five cells, in each of which there is a row of some 6-12 white cacao beans embedded in a sticky, acid pulp. A single ripe pod will yield from 20-60 of these beans.

The ripe pods are harvested with a hooked hatchet, which is attached to the end of a bamboo pole. They are broken open and the slimy mass of seeds and pulp is extracted. Two men, working together, or a man and wife, will pick and shell as many as 1,600 pods a day; the beans are measured off into standard boxes and the price paid varies with the seasonal fluctuation in crops. The season lasts from about the beginning of December to the end of March, and during this period they may earn about $48 a week.

By using fertilisers and high-quality seedlings it is possible to obtain over 1,000 lb. of dry cacao beans per acre, but the overall average in Trinidad is now nearer 400 lb. per acre. This is the reason why the Government is supplying seedlings free to the growers.

The cacao beans

On arrival at the factory the beans are put into 'sweat boxes' or they may be placed in heaps and covered with banana leaves. Bacterial action causes the pulp to ferment and the beans get so hot that it is impossible to put one's hands into the mass. In the sweat boxes it usually takes from five to eight days to complete the process of fermentation, when the beans are dark brown in colour. Fermentation destroys the mucilage and the beans lose some of their bitter flavour.

The beans are then sun-dried on a flat drying floor or barbecue, bordered by rails, along which a sliding roof can travel to cover them at night or if rain threatens. The next process is

Right: *Young cacao plants in the final stage of hardening before planting out. Note the leaf trimming.* Left: *Cuttings taken from selected trees are treated with a root-inducing hormone and placed in potting soil in woven baskets.*

'Dancing the cacao' on a heap of dried beans. Note the sliding roofs in the background

polishing to give the beans a brighter appearance. This is done by a number of men who shuffle round and round a heap of the beans, an operation known as 'dancing the cacao'. The object is to remove mildew and any remnants of dried mucilage. The dried cacao beans are packed into bags and are then ready for shipment and processing into cocoa and chocolate.

Silwood Park

Colonial Spraying Machinery Centre

For some years the Imperial College of Science and Technology has been using spraying and dusting machines and implements for the instruction of students and for research and experimental purposes. Recently after discussions between the Colonial Office, the Agricultural Engineers' Association and the College authorities, it was decided to set up a permanent exhibition at the field station of the Department of Entomology at Silwood Park of different types of spraying and dusting equipment, loaned by the manufacturers for the benefit not only of the students, but also for the instruction of overseas visitors.

Formal courses of instruction in the principles of the applications of dusts and sprays are held for overseas officers on vacation or study leave, and an overseas visitor is assisted in the choice of the type of machine for his particular problems. In support of this a comprehensive library of manufacturers' literature is available for him to make his final selection from all the machines of this type that are produced.

The Director of the centre is Mr. A. E. H. Higgins, and he is assisted by an engineer and a mechanic, so that it will be possible to demonstrate any of the machines and implements in the pool.

Applications to visit the centre should be addressed to the Officer-in-Charge, Colonial Spraying Machinery Centre, Imperial College of Science and Technology, Silwood Park Field Station, Sunninghill, Berkshire. The station is situated in the beautiful country adjoining the Windsor Great Park and is about seven miles from Windsor Castle.

Farms in Kenya

In February, the East African Statistical Department published a detailed report on the 1958 Agricultural Census of the non-African areas of Kenya under the title 'Kenya European and Asian Agricultural Census, 1958—An Economic Analysis'.

This report represented a most valuable addition to knowledge of farming in the non-African areas and of its contribution to the economy. In particular, a series of tables summarising the results of censuses held in the years 1954-58 brought out the changing pattern of non - African farming.

More farm holdings

The report shows that the number of non-African farm holdings increased from 3,540 in 1958 to 3,593 in 1959, and the total acreage under crops increased slightly although a reduction in the area planted to maize and barley was recorded.

There were 28,000 acres under pyrethrum in 1959, compared with 22,000 acres in the previous year, and among plantation crops significant increases in the acreage under sugar, tea and coffee occurred.

Of a total capital expenditure on non-African farms and estates of nearly £5½ million in 1959, the greater part was on mechanical equipment and plantation development. A small increase in the number of tractors on farms was recorded in 1959, although there was little change in the number of harvesters.

African farms census

The report on the 1958 Agricultural Census recognised that the picture of Kenya farming would not be complete until full details were available of farming in the African areas. The East African Statistical Department, in collaboration with the Agricultural Department, is carrying out a sample census of African farms this year as part of the 1960 World Census of Agriculture. Pilot studies were completed in 1959 and at the present time field work as part of the survey proper is in progress in Central and Nyanza Provinces and in parts of Southern and Rift Valley Provinces. The work in the field is being undertaken by officers of the Agricultural Department.

Chemical Nomenclature—1. Insecticides

There is an extraordinary degree of confusion in the nomenclature of chemicals used in crop protection. This is a list of chemical, trivial and trade names for some common insecticides and acaricides. Similar lists of weedkillers and organic fungicides will be published in future issues.

Chemical Group and Name	*Trivial Name Proposed or Accepted*	*Trade Marks of Some Formulations in Common Use*
I. CHLORINATED HYDROCARBON INSECTICIDES		
hexachlorocyclohexane (alt. benzene hexachloride)	BHC (gamma isomer = lindane)	
1,1,1-trichloro-2,2-di-(p-chlorophenyl) ethane	pp' DDT	
*1,2,3,4,10,10 hexachloro-6,7 epoxy-1,4,4a,5,6,7,8,8a octahydro *endo* 1,4 *exo* 5,8 dimethanonaphthalene	dieldrin	
*1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a hexahydro *endo* 1,4 *exo* 5,8 dimethanonaphthalene	aldrin	
*1,2,3,4,10,10 hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a octahydro *endo* 1,4 *endo* 5,8 dimethanonaphthalene	endrin	
1,4,5,6,7,10,10 heptachloro 4,7,8,9 tetrahydro-4,7-*endo* methyleneindene	heptachlor	
1,2,4,5,6,7,10,10 octachloro-4,7,8,9-tetrahydro-4,7-*endo* methyleneindane	chlordane	
1,1,1-trichloro-2,2-di (p-methoxyphenyl) ethane	methoxychlor	
II. ORGANOPHOSPHORUS INSECTICIDES		
dimethyl p-nitrophenyl phosphorothionate	parathion methyl	
diethyl p-nitrophenyl phosphorothionate	parathion	
S-1,2-di (ethoxycarbonyl) ethyl dimethyl phosphorothiolothionate	malathion	
dimethyl-S-(N-methylcarbamoylmethyl) phosphorothiolothionate	(dimethoate)	'Rogor'
O,O-dimethyl (1-hydroxy 2,2,2 trichloroethyl) phosphonate	(trichlorphon)	'Dipterex'
diethyl 6-methyl-2-isopropyl-4-pyrimidinyl phosphorothionate	diazinon	
dimethyl-S-(ethylthioethyl) phosphorothiolothionate	thiometon	'Ekatine'
diethyl-S-(p-chlorophenyl-thiomethyl) phosphorothiolothionate		'Trithion'
S-(3,4-dihydro-4-oxobenzo triazinyl) methyl dimethyl phosphorothiolothionate		'Guthion'
2-ethylthioethyl dimethyl phosphorothionate	demeton-O-methyl	
S-(2-ethylthioethyl) dimethyl phosphorothiolate	demeton-S-methyl	
mixture of demeton-O-methyl and demeton-S-methyl (*q.v.*)	methyl demeton	'Metasystox'
dimethyl 1-carbomethoxy 1-propen-2-yl phosphate	(? phosdrin)	'Phosdrin'
diethyl-S-(2-ethylthiomethyl) phosphorothiolothionate	(phorate)	'Thimet'
dimethyl diethylamido-1-chlorocrotonyl (2) phosphate	(? phosphamidon)	'Dimecron'
III. MISCELLANEOUS INSECTICIDES		
N-methyl-1-naphthyl carbamate		'Sevin'
fluoracetamide	fluoracetamide	
IV. ACARICIDES		
ethyl-4,4'-dichlorobenzilate	chlorobenzilate	
2,4,5,4'-tetrachlorodiphenyl sulphone		'Tedion'
2-(p-tert-butylphenoxy)-isopropyl 2'chloroethyl sulphite	(? aramite)	'Aramite'
1,1-bis (p-chlorophenyl)-2,2,2-trichloroethanol		'Kelthane'
4-chlorobenzyl p-chlorophenyl sulphide	chlorbenside	'Chlorocide', 'Mitox', 'Chlorparacide'
bis-(p-chlorophenoxy) methane		'Neotran'
4-chlorophenyl p-chlorobenzene sulphonate	chlorfenson (ovex—U.S.A.)	'Ovotran'

(N.B.—Names bracketed are proposed only—others are accepted)

* U.S.A. nomenclature.

New Publications

British Parasitic Fungi

By W. C. Moore. Pp. 430. Cambridge University Press, London, 1959. Price 45*s*.

The aim of this book cannot be better stated than in the words of the author: 'To prepare a reference book from which the plant pathologist can readily trace the parasitic fungi which have been reported on cultivated plants in Great Britain, the diseases caused by these fungi, and British literature on the subject'. This aim has been fulfilled in an outstanding manner.

The text is in two parts. Part 1 is an alphabetical list of host plants with standard Latin names and their English equivalents. Under the Latin name of each plant is the list of parasitic fungi known to occur on it in Britain. These lists may be of formidable length, *e.g.* 38 fungi on potato, 13 parasites and 21 troublesome 'weeds' in mushroom cultivation. Apple, with 60 fungi infesting it, seems to hold the record.

Part 1 is really a stepping stone to the much longer Part 2, which gives, under the Latin name of each fungus (in alphabetical order), a summary of the relevant information: history of the disease, plants affected, regional distribution, importance etc., together with references to all the significant British literature. These summaries range from a few lines for a disease of little importance to as much as seven pages for *Phytophthora infestans* on potato, the extensive literature on which is further classified under such headings as 'Source of Disease', 'Forecasting', 'Losses Caused', 'Physiological Races', 'Spraying and Dusting' etc.

Most of the references lie within the past 50, or even 25, years, but for important and long-established diseases, *e.g.* potato blight, they go back much farther, and some of these are of special value, as the original papers are liable to be lost sight of. The same may also be said of some modern reports which the author has sifted and which would otherwise be unknown to most workers in the subject.

Treatment of each topic is accurate, clear and critical. Thanks to the excellent format, the uniformity of presentation and other aids which the user will soon discover for himself, any student or other interested person will have no difficulty in tracking the essential literature on any fungal disease of any British crop plant and doing so in a matter of a few minutes.

W. BROWN

Technical Books
308 Euston Road
London, N.W.1
(Tel: EUSton 5911)

as retail booksellers will be pleased to supply any books reviewed in this periodical, and will give immediate attention to any requirements you may have for other works

Farming Arid Lands

Field Studies in Libya. Edited by S. G. Willimot and J. I. Clarke. Pp. 138. Illus. and diagrams. Durham Colleges, University of Durham, 1960. Price 21*s*. (overseas).

The Geography Department of the Durham Colleges, University of Durham, is currently engaged in a major project of overseas research involving economic and social problems in certain parts of the Middle East. The present publication summarises the results of two years' work in the form of 12 papers.

The first, by R. W. Hill, is entitled 'Underground Water Resources of the Jefara'. The author states that 'in recent years there has been a remarkable switch from dry to irrigated farming and even today farmers continue to install pumps and other irrigation equipment'. Fortunately, the geological structure of the area favours the accumulation of underground water. A detailed survey was made to determine whether the water is available in large quantities and is of good quality.

The author of this paper concludes that consumption exceeds the rate of renewal in some places, so that the water table is falling. Some action may have to be taken to curtail consumption (by the introduction of sprinkler systems?) and the use of brackish and saline waters on certain soils and for certain crops is considered.

The second paper, by S. G. Willimot, is entitled 'Soils of Jefara'. By virtue of its agricultural resources, the Jefara plain is the most important economic region in Libya. This was regarded as the 'Garden of the Mediterranean' during Roman times, but 'Libyan agriculture fell into serious decline with the fall of Rome and the increasing encroachments of the nomads'.

Then there follows a melancholy picture of loss of soil fertility, collapse in crop yields, decline in population and the need to import corn to avert starvation. The loss in fertility is attributed to soil desiccation caused by the removal of forests, bad land use with consequent erosion, and loss of top soil.

The recent discovery of economic deposits of oil should provide the means for a radical change in policy and for the rehabilitation of this once fertile region. An adequate proportion of the oil revenues will need to be ploughed back into agriculture in order to raise the present low level of existence.

In the third paper the author, C. Vita-Finzi, gives his observations on the processes of soil erosion, gullying and soil deposition which occur during those few days of the year when rainstorms cause short-lived floods. The title of his paper, 'Post-Roman Changes in Wadi Lebda', alludes to the changes that have followed the neglect and destruction of the water-control works of the Romans.

Other papers deal with the pastoral people and the nomads and considers the social and economic consequences of the Wadi Cam Development Project and the present position and possibilities of various economic crops, such as groundnuts, olives, vines etc.

This programme of field research, so ably described, has been carried out

through the generosity of the Rockefeller Trustees, but it is only a beginning. Much, much more is needed.

This valuable review should be in the library of every development project and in all universities and in schools where economic geography is taught. Agriculture holds the key to the future of mankind and man's environment is one of the most important human studies. Unfortunately, it is not so rewarding or sensational as rocketry, on which so much money and human effort is being lavished today in the U.S.A., the U.S.S.R. and the U.K.

F. C. COOKE

Plant Breeding

Report of the Welsh Plant Breeding Station, Aberystwyth, 1959. Pp. 120. Obtainable from the Secretary. Price 10*s*., post free.

The first annual report of the Welsh Plant Breeding Station for 1959 has recently been published by the University of Wales. It is intended to give publicity to research problems which are either nearing completion or where significant developments are expected in the near future. The Director of the station states that the amount of data for publication is increasing rapidly, but, owing to pressure on space in scientific journals, there is often a considerable delay before fully documented papers can appear in print. Under the circumstances it was considered desirable to issue an annual report from the station.

Hitherto the results of work at the station have been published in numerous scientific journals and in the station's bulletins and leaflets. In addition, three reports covering the periods 1919-33, 1950-56 and 1956-58 have been published, and a full bibliography of publications up to 1955 is available as a separate volume.

The present publication includes the Director's report for 1959, research reports from nine divisions of the station and a number of short papers, written by individual members of the staff, designed to emphasise certain problems which are considered to be of topical or special interest.

This decision to publish an annual report of this important research centre is a happy one, for there appears to be no reason why the station should rely on other scientific journals to give publicity to the results of their work and good reasons why the station should develop this plan to centralise the publication of their work.

D. H. GRIST

Dictionary of Agriculture

By G. Haensch and G. Haberkamp. Pp. 649. In Eng., Fr., Ger. and Sp. Crosby, Lockwood & Son Ltd., London, 1959. Price 85*s*.

Linguists and agricultural experts from many countries have assisted in the production of this valuable book of reference, which covers all branches of modern agriculture in 13 sections, with over 7,000 technical words listed in four languages, and a numerical system for back reference from the alphabetical indexes.

The authors have succeeded in producing a useful aid to international collaboration in agricultural science and to better understanding between delegates at international agricultural conferences, where language is an almost insuperable barrier.

Manuring

Soils and Manures for Vegetables. Bulletin No. 71, Ministry of Agriculture, Fisheries and Food. Third edition, 1959. Pp. 78. London: H.M. Stationery Office. Price 5*s*. 5*d*., post free.

This third edition of a well-known bulletin is, in effect, a new publication, having been entirely rewritten. It gives information on all types of soils suitable for vegetable growing and the appropriate fertilisers and manures to use for each.

The fundamental work on mineral nutrients and deficiencies is fully dealt with and practical recommendations made concerning major and micronutrient deficiencies. Problems arising from the scarcity of animal manures and the high cost of concentrated organic manures are examined from a practical standpoint.

Current practices of vegetable growers are considered in the light of experience of scientific and horticultural advisers in vegetable-growing areas. Most of this information is intended for commercial growers, but a final chapter on manuring gardens and allotments brings out the main points of importance for the amateur gardener.

Bulletins and Reports

U.S. Department of Agriculture. 'Irrigating Corn in Humid Regions'. Farmers' Bulletin No. 2143. November 1959. Price 10 cents.

'Increasing Potato-Harvesting Efficiency'. Agriculture Handbook No. 171. December 1959. Price 15 cents.

'Availability of Water to Crops on Saline Soils'. Agriculture Information Bulletin No. 210. November 1959. Price 10 cents.

'Cotton Production in Africa'. Foreign Agriculture Report No. 117. February 1960. Price 25 cents.

All obtainable from the Government Printing Office, Washington, 25, D.C.

Ontario Department of Agriculture. 'Horticultural Experiment Station and Products Laboratory Report for 1957 and 1958'.

'Protection Against Frost in Southern Ontario'. Publication No. 26. April 1960.

'Cabbage, Cauliflower, Broccoli and Brussels Sprouts'. Publication No. 117. Revised March 1960.

'Peppers and Eggplants'. Publication No. 196. Revised April 1960.

'Pruning the Tree Fruits'. Publication 392. Revised February 1960.

'Orchard Soil Management'. Publication No. 457. Revised April 1960.

All obtainable from the Ontario Department of Agriculture, Parliament Buildings, Toronto, Canada. Prices not stated.

O.E.E.C. 'Fertilisers—Production, Consumption, Prices and Trade in Europe and U.S.A.'. Ninth Study, 1957-60. March 1960. From Organisation for European Economic Co-operation, 2 rue Andre-Pascal, Paris 16e, France. Price not stated.

Commonwealth Economic Committee. 'Fertilisers in the Commonwealth, 1950-58'. From the Commonwealth Economic Committee, 2 Queen Anne's Gate Buildings, Dartmouth Street, London, S.W.1. Price 4*s*.

D.S.I.R. 'Fumigation with Methyl Bromide under Gas-proof Sheets'. Pest Infestation Research Bulletin No. 1 (second edition). Obtainable from H.M.S.O., York House, Kingsway, London, W.C.2. Price 4*s*. 6*d*.

Federal Trust for Education and Research. 'The Commonwealth and Europe'. Obtainable from the Federal Trust, 10 Wyndham Place, London, W.1. Roneo report on three-day symposium held in May.

A Prospector dusting a field of peas in Lincolnshire

Spraying and Dusting Implements and Machinery

IT is a fact, not generally realised, that if we exclude Russia, three-quarters of the world's agriculture is carried out by small farmers, smallholders and market gardeners and also on small allotments. Far too little is being done, particularly in the undeveloped and under-developed countries, to assist the small man by providing him with the tools for the job—a hand sprayer or a hand duster, or both—so that he is in a position to control the pests, diseases and weeds which reduce his crops. If we are really serious about increasing the food supplies in these countries, this is a question which needs to be looked into by those responsible for the administration of agriculture in these territories.

Apart from this, the larger farms, the plantations and grasslands of the world and tall and inaccessible crops, like forests, coconuts and wet rice, require spraying and dusting machinery which will do the job as quickly, as cheaply and as effectively as possible. The following account of the production of various firms is presented in alphabetical order.

The following is an account, necessarily brief, of some of the machines and implements for applying dusts and sprays which have been seen at various shows, demonstrations and exhibitions during the past six months.

E. Allman & Co. Ltd.

After seeing the static display of spraying machines on their stand at the last Smithfield Show (*vide* WORLD CROPS, **11**, 1959, 445), it was doubly interesting to see a 'live' display of all their machines and equipment on a Sussex farm in a perfectly timed demonstration.

The star performer was the 'Speedi-spray 60', which is fitted with the new Allman - Hypro 'Rollervane' pump. This will give working pressures of up to 200 lb./sq. in., depending on the size of the nozzles used, and, in spite of being a low-volume machine, application rates of up to 40 gal./acre at 4 m.p.h. are possible. Demonstrated working at this speed, the Allman ceramic fan nozzles gave an efficient spray pattern.

The unit can be easily mounted on the three-point mounting of category 1 and 2 linkages. Essentially the sprayer consists of a 60-gal. cylindrical tank, with dished ends to give strength, a three-stage filtration system and an 18-ft. spray boom, fitted with 12 spray jets, which is adjustable for height from 15-46 in. The two arms can be folded vertically from the tractor seat for travelling along the road, and there is also a safety breakaway with automatic return to the correct position for spraying. The hose connecting the pump to the sprayline is made of a special high-pressure rubber which will handle oil-based sprays satisfactorily.

Cook & Co. (Manchester) Ltd.

The 'Granula' is described by the makers as a dual-purpose applicator for granules and dusts. It is a knapsack type of machine which is actuated by a reciprocating lever operated by

one hand, while the dust delivery tube is directed on to the target by the other. It is a simple machine which is claimed to give an accurate, uniform and continuous flow of dust or granules (see WORLD CROPS, 1958, **10**, 343).

Cooper, Pegler & Co. Ltd.

This company claims to have a machine for every problem and every crop, and for high-volume and low volume spraying. The outputs of these machines range from 3-525 gal./hour, the tank capacities from as little as 3½ pt. to 176 gal., and the operating pressures from 20-570 lb./sq. in.

For the small man the company offers the 'Plafog', a small ½-gal. hand sprayer with a robust plastic container; the 'Hawk', a 'water-bottle' pneumatic sprayer of 1 gal. capacity with a light hand lance; the 'Falcon', a lightweight knapsack and lance sprayer of 2 gal. capacity; and the 'Hydra 60', a syringe model, which can be supplied with liquid either from a bucket or from a 1- or 2-gal. plastic 'water bottle' carried by a plastic shoulder strap. They also have a similar range of bellows dusting machines.

W. J. Craven & Co. Ltd.

Included among the sprayers and dusters offered by this company is the

The 'Hydra 60' syringe model, by Cooper, Pegler, with a 2-gal. plastic spray bottle

'Hydraulic Minor', a high-pressure spraying unit which can be carried from place to place over rough ground, as it is built into a light tubular carrying cradle which can be borne by two men. Where the going is easier another version with a wheeled chassis can be used. This compact machine has been specially designed for use on plantations of crops, such as bananas, where it is difficult to get inside the fields owing to obstructions, such as decaying tree trunks, field drains or dense foliage. The sprayer will operate at a pressure of up to 350 lb./sq. in. and deliver 2 gal./min.

Dorman Sprayer Co. Ltd.

What is claimed by the makers to be one of the biggest advances in the development of crop spraying machinery is their 'no-drift' system of application, which was demonstrated at this year's Royal Show and is incorporated in two-thirds of their total production.

One of their machines, the 'Osprey Ace', will dust, spray and also send out spray and dust mixtures without any pre-mixing being necessary. It is a motorised knapsack unit with a flexible arm blower of considerable length, so that the orifice is well away from the face of the operator. This is made possible by a long carrier arm which supports the nozzle, while the hose is flexible for the whole of its length.

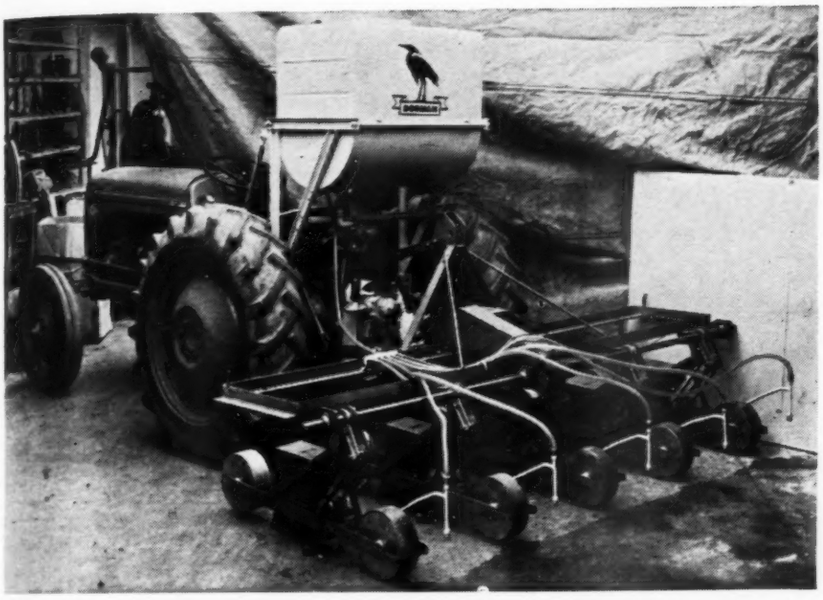
Drake & Fletcher Ltd.

In the range of machinery shown by this company at the Royal Show at Cambridge was the new 1960 'Victair' tractor-mounted mistblower with its trailer tank and the 1959 'Wasp', also a mounted mistblower, but with the spray tank carried on the tractor. A selection of their knapsack sprayers, shoulder-mounted mistblowers and dust guns were also displayed.

The new Allman 'Speedispray 60' boom sprayer with narrow row-crop wheels

Evers & Wall Ltd.

One of the interesting machines seen by our representative for the first time at Silwood Park Demonstration Centre was the 'exhaust nozzle' sprayer for desert locust control. The new technique has already been described in WORLD CROPS, 1959, **11**, 70.



Dorman sugar-beet band sprayer mounted on the Massey-Ferguson '35' in conjunction with the Stanhay precision drill

The unit is attached to a *Land-Rover* and the power from the exhaust is used to pressurise the spray container and force the liquid to the nozzle, atomise it and then spread it over the countryside by wind drift. When the vehicle is travelling at 5 m.p.h. with the wind blowing at 5-10 m.p.h. a deposit of $\frac{1}{4}$ pt./acre is obtained for a swath of 120 yd.

Improved Spray Products Ltd.

A new lightweight knapsack sprayer has just been introduced by this company. To ensure lightness, it consists of the bare essentials—a flat 3-gal. polythene container, a hand-operated diaphragm pump and a press-button lance securely retained by a brass strap; the unit is carried on shoulder straps padded with sponge rubber, covered with plastic material. The flat face of the container is marked in gallons and litres and it can be easily removed for filling or cleaning.

Jaydon Engineering Co. Ltd.

This company have been showing two outstanding machines, the new 'Swingfog', type SN7, and the 'Fontan' motorised knapsack sprayer. The former is a portable unit weighing only 32 lb. (filled), which can be carried by one hand or by means of a shoulder strap; it can be used either as a flame thrower for destroying ground pests and killing weeds or as a producer of an insecticidal fog which will filter through the dense foliage of tree and bush crops. It can be used in thickly wooded and hilly country, which is inaccessible to many types of spraying machines.

The 'Fontan' is a portable low-volume sprayer which can also be used for misting and dusting and also, with a special hood attachment, as a flame thrower. It is powered by a 2.5-h.p. two-stroke engine which is coupled directly to a high-efficiency blower which produces the large volume of air necessary to generate an atomised spray, which is said to give ample penetration without blast. The spray is so fine and the leaf coverage so good that a considerable saving in labour, transport, material and time results. Otherwise expressed, the fine droplet size gives such good coverage that less material is required.

Kestrel Engineering Co. Ltd.

At the Royal Show this year this company were showing no less than four new machines: the 'Minipak', a 25-lb. motorised knapsack unit, which can be converted from a sprayer into a duster or into a flame thrower in a minute or so; the 'Powerpak', a larger model with a larger engine which can reach to a height of 30 ft.; and the 'Cascader', a small tractor-mounted sprayer with a tank capacity of either 35 gal. or 66 gal. It is an atomiser with an air blast of approximately 210,000 cu. ft./hour and the

Evers and Wall spraying unit for locust control, as attached to a Land-Rover

liquid pump delivers at the rate of 13 gal./min. at pressures up to 710 lb./sq. in.

For the small man they offer the 'Polypak' knapsack sprayer, which is made of corrosion - proof material throughout. There is a detachable polythene container (2, 3 or 5 gal.), which is carried on the back, and polythene-lined lances with trigger control. They have also a small knapsack duster of sturdy construction.

Micron Sprayers Ltd.

The rotary atomiser, which is exclusive to their machines, will, it is claimed, produce 100 times as many droplets as an ordinary jet sprayer. These superfine droplets will cover the foliage evenly and dry quickly, and operating economies result because less spray chemical is used, time is saved and much less water is required. A brochure, 'The Reason Why', may be obtained through our Reader Service.

While the company produces a range of large sprayers and power dusters, this account calls for particular mention of the 'Micronette', first introduced in 1957. This is a lightweight motorised knapsack sprayer of well-balanced design, in which the unit is nicely balanced by the weight of the polythene spray container, which is carried in front of the operator.

Ransomes, Sims & Jefferies Ltd.

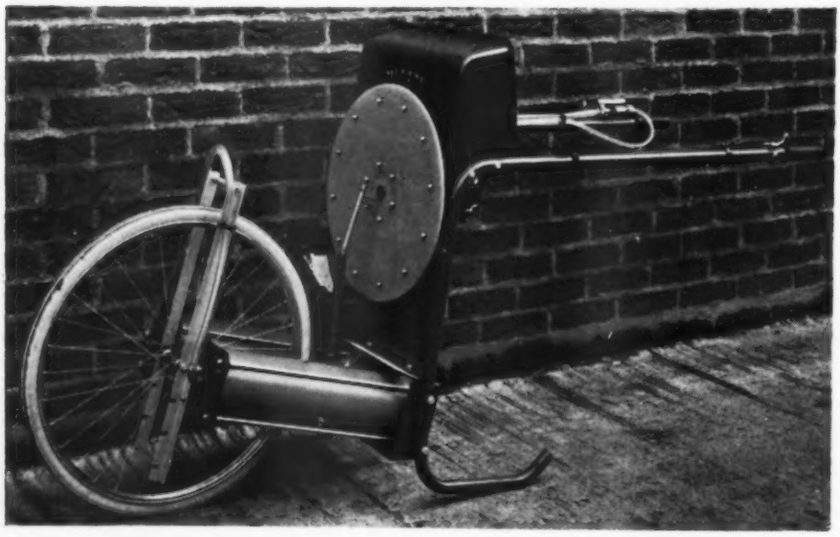
The 'Cropguard' sprayer is a sturdy tractor-mounted sprayer primarily intended for the farmer with a small acreage. It is designed for use with the *Fordson* 'Dexta' or 'Major' and the range includes the 'Junior' low-volume sprayer with a 30-gal. tank, the 'Standard' medium-low-volume machine with a 60-gal. tank, and the senior high-low or medium-low model with a 100-gal. tank. The spray boom is of exceptional rigidity and the outer sections can be folded to allow the machine to pass through farm gates and travel along the roads. The standard boom is fitted with 11 jets and the ceramic tips of the nozzles are sealed into brass holders and designed to resist abrasive materials and to resist corrosion.

The 'Cropguard Junior' sprayer used for low-volume spraying, fitted with a 30-gal. tank. The outer sections of the 17-ft. boom can be folded for movement along roads

Silver Creek Precision Ltd.

Their 'Microsol' mechanical fog generators are designed to provide positive control of pests and bacteria when used in conjunction with suitable chemicals. They will handle clean liquids or emulsions with a wide range of particle size. The machines have been designed for indoor use in public health protection and the food industry and are of particular importance in dealing with pests of stored grain.

The 'Microto-Treating 128' sprayer and mister unit can be used on almost any type of crop, or for mosquito or locust control. The machine consists of a power unit and fan, to which is fitted the air handling system with bifurcated trunking, flexible arms and adjustable hands with eight spray fingers. The duster unit, which can be fitted on to the main block in place of the sprayer, can deliver either wetted or dry dust at any angle.



Micron monowheel atomiser for vineyards, cordon fruit and tomatoes or any crop planted in hedges 6 ft. high and 6 ft. apart

Reader Service

For further information on any item reviewed in this issue please use the card provided or write to:

Reader Service,
World Crops,
Leonard Hill House,
Eden Street, London, N.W.1,
England

Agricultural Chemicals

Tapping Panel Disease

Severe damage is done to the tapping panels of rubber trees by various fungi. Mouldy rot, caused by *Ceratostomella fimbriata*, is by far the most important panel disease during the wet season. An effective method of control, recommended by *Sandoz Ltd.*, is to apply to the dry tapping surface a fungicide, 'Antimucin WBR', at the rate of 1 fl. oz. in 2½ gal. of water, *i.e.* 0.25%, and at regular intervals of 7-10 days throughout the rainy period. Virulent infections in wet climates necessitate application every 3-5 days. Though water miscible, this product, which contains an active mercury compound, has cellulose-fixing properties, and so the impregnation of the bark makes the application sufficiently rain-fast.

Higher concentrations of this fungicide are required for the control of stripe canker (black stripe disease, bark rot) caused by *Phytophthora palmivora* and/or *Pythium complectens*. Black stripe disease has considerably increased in recent years, obviously in connection with a simultaneous increase in *Phytophthora* leaf disease. The recommended treatment with 'Antimucin WBR' against stripe canker is in dilutions of 0.4-0.7%, to be painted before tapping or reopening the trees, at intervals of 4-6 days. In addition to painting, the tapping panels and canker patches may during the wet season also be sprayed with 'Antimucin WBR' once a month at various concentrations, depending on the locality.

For Pesticide Formulations

Fuller's earth is the name given to certain non-plastic or semi-plastic, soft clay-like materials because of their power to absorb grease and remove colouring matters from cloth. At one time this material was principally used by fullers to remove grease from wool and woollen goods. Although these processes still persist, the main use for both the natural and the activated product today is for bleaching and decolorising animal, vegetable and mineral oils and as an ingredient for insecticidal sprays and dusts. Its industrial value depends mainly on its physical structure. These earths are calcium montmorillonites and because of their extensive surface they provide a very absorbent carrier and adhesive agent for pesticides and other active materials. Further information can be obtained through our Reader Service from *Fullers Earth Union Ltd.*

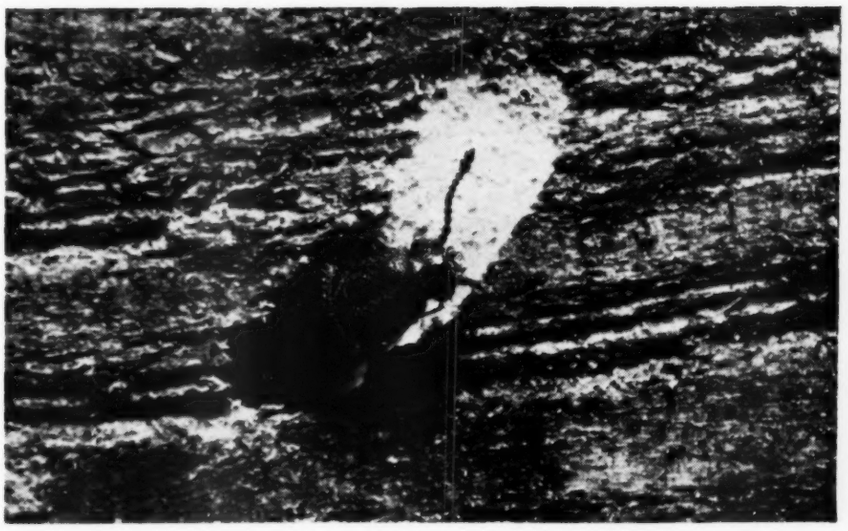


Photo: Preservation Developments Ltd.

Lyctus brunneus *emerging from infested Japanese oak*

Compendium of Plant Diseases

The *Rohm & Haas Co.* has published a book, entitled 'Compendium of Plant Diseases', with illustrations in colour of the appearance and symptoms of the most important diseases of crop plants. It is presented in four parts: diseases of vegetables, diseases of field crops, diseases of fruit and nut crops, and diseases of other economic crops; and the descriptions tell how and where the disease develops and suggests general control measures. No reference whatever is made to the products made by the company, such as 'Lethane', 'Rhothane', 'Dithane', 'Perthane', 'Kelthane' and 'Karathane', although they are all important weapons in the war on pests and diseases. Copies can be obtained at $3 each from the company.

Dry Rot, Woodworm and Termites

Two chemicals are offered by *Preservation Developments Ltd.* for the eradication of woodworm, dry rot and termites in timber. They are 'Brunophen No. 2' and their latest product, 'Brunophen R-60'. Both of these are insecticidal and fungicidal and are based on pentachlorophenol and dieldrin, together with other active ingredients. The former is used for treating old timber *in situ* in unoccupied premises and for treating new timber; the latter, having an unusually pleasant odour, is for use in occupied premises.

Eradication of dry rot and woodworm demands careful attention to detail, and details of the procedures to be followed have been prepared by the manufacturers and may be obtained through our Reader Service.

Giant Beets

Yields of nearly 25 tons per acre—10 tons above average—were obtained last year by a Nottingham farmer, Mr. C. H. Marshall, from a new variety of sugar-beet, Zwaansee III, which is now on the recommended list of the National Institute of Agricultural

Botany. Some of the roots were over 14 lb. in weight and the sugar content was between 15% and 18%. This field trial was carried out on 16 acres of medium loam, without special treatment.

The new variety was bred by *Zwaansee Inc.* at their testing station at Voorburg in Holland and *E. W. Nickerson & Sons Ltd.* are the sole agents in the U.K.

Selective Weedkillers

A selective weedkiller is one which will kill some plants and leave others relatively unharmed. The *Murphy Chemical Co. Ltd.* offer a range of such weedkillers for different purposes: thus ' Runcatex CMPP ' is a non-poisonous formulation which will control cleavers, chickweed and many other weeds in cereal crops; ' Forlay MCPB ' is offered for safe and effective weed control in undersown cereals and pastures (permanent or ley); ' Dinamene DNBP ' will effectively control weeds in peas, sainfoin, vetches and lucerne. Murphy MCPA and ' Mecpa Special ' are hormone formulations for weed control in cereals, pastures and leys containing red clover, linseed and asparagus; in the former the MCPA is in the form of the potassium salt and in the latter as mixed sodium and potassium salts.

Aquatic Weedkiller

A new weedkiller for the control of rushes, reeds, sedges and other emergent water weeds in ditches, drains, dykes and irrigation canals has just been introduced by *Borax Consolidated Ltd.* The product is applied in solution at rates varying from 15-30 lb./acre, applied at a slow walking pace by means of hand lances. This eliminates the laborious hand cutting and clearing which has long been a problem to drainage boards. With the increasing non-availability of labour, able and willing to do this type of work, it is a real problem to know what to do.

While the cost of the chemical is a consideration, it must be remembered that if the drains are neglected to the point when the flow of water ceases, the adjacent land will become waterlogged and progressively less productive. The resulting decline in land values is the real factor to be set against the cost of the treatment. The dead reeds remaining may either be burned or left to rot away; they do not need to be cut and the treatment is effective for one or two years.

Bronzing of Oil Palms

It has been found that the physiological disturbance known as 'bronzing' can be divided into two types, 'orange spotting' and 'yellowing', according to a paper by J. K. Coulter and E. A. Rosenquist, first published in the *Malayan Agricultural Journal* and now available as a reprint from *Verkaufsgemeinschaft Deutscher Kaliwerke G.m.b.h.* The former can be correlated with the magnesium content of the frond, while 'orange spotting' is connected with a deficiency of potassium.

' Mist-O-Matic ' machine operating with a modern seed grading and cleaning installation

A system of marks to measure the degree of these two characteristics has been used at the Federal Experiment Station at Serdang in Selangor to correlate the scores with yield, and it has been shown that a high degree of 'orange spotting', *i.e.* a deficiency of potash, is associated with a reduced yield.

Practically all the work carried out in Malaya and Africa has emphasised the need for the balanced manuring of oil palms, which appear to be particularly sensitive to nutrient ill balance. Thus, when considering the manuring of oil palms, it is not only a question of how much and how often, but also in what ratios and in what form.

The results of this work show that calcium can depress the uptake of potassium, but that this is only likely to have ill effects where the potassium supply is marginal. If adequate amounts of potassium are provided, it is unlikely that the calcium would have ill effects. A comprehensive brochure on this subject is available through our Reader Service.

Drift Dusting

Drift dusting was developed in the tropics for the rapid treatment of large areas where water is a barrier; it has since been tested in Britain and found to be a highly successful method of crop protection for potatoes and hops. This method makes use of a drifting cloud of active fungicidal particles generated on the windward side of the area under treatment with the dusting machine moving at about 5 m.p.h.

Universal Crop Protection Ltd. recommend the use of 'Cuprosana H' a copper dust formulation containing 6% of active copper (12% copper oxychloride) mixed with a special carrier and sticking agent to ensure effective coverage even at low rates of application per acre. Drift dusting, it is recommended, should not be done in high winds or when rain is expected. Dusting during the early morning or late evening, when dew and moisture are on the leaves, gives the best results.

Seed Dressing Revolution

The biggest problem with liquid seed dressings is that of trying to get infinitely small amounts of the liquid evenly distributed over each and every grain.

A new principle to ensure the effective treatment of seed has been introduced by *British Schering Ltd.* It depends on the atomisation of liquid fungicides and insecticides and the production of a fine mist which penetrates into the crevices and indentations of each grain as the stream of seed passes continuously and rapidly through the 'Mist-o-Matic' machine.

The atomised liquid dressing of mixed mercurial fungicide and insecticide is absorbed and retained by the seed coat. The remarkable uniformity of this deposit was apparent from the even red staining of each single grain, as seen by our representative in a recent demonstration.

World Crop Reports

Increase in World Cereal Production

INTERNATIONAL REPORTS

Cereals

World output of cereals (including rice) in 1959-60 is estimated to be about 600 million tons, according to FAO. The report of the Study Group on Grains states that the global increase in cereal production was about 15 million tons over 1958-59.

World production of wheat was about 2.5 million tons short of the output in 1958-59, while coarse grains production rose by about 14.5 million tons. All these figures excluded China and the U.S.S.R., but included Eastern Europe.

Grains production was again at a record level in 1959-60 and carry-over stocks both of wheat and coarse grains this year will be larger than the previous year's record, although 'consumption, too, had risen to new high levels'.

For the crop year 1960-61 the committee said that grains production may be as large as in 1959-60, with some regional changes and variations. The 1960 harvest in the U.S.S.R. might well be higher than that of 1959, but lower than that of the record year 1958; winter wheat is reported to have suffered, but sowings of spring wheat and maize have been expanded.

A slight decrease in wheat production was likely in Western Europe, partly because of reduced acreage and to some extent possibly due to the drought in 1959. Poland had to replant one-half of its land; prospects in Yugoslavia were fairly favourable. Canadian acreage was expected to be almost the same as in the previous year. In North-West Africa the wheat crop was expected to be generally good; the outlook for Turkey was excellent.

The Grains Group, in preparing its report, considered an FAO document on future trends in production and consumption of grains (see WORLD CROPS, 1959, **11**, 304). The average annual increase in production in the coming years could be 'expected to be of the order of 7-8 million tons'.

Regarding future consumption, the committee said that *per caput* intake in the advanced regions might remain the same or even go down, but in certain less developed countries there was 'a large potential demand for wheat and rice'. The strong upward trend in the consumption of coarse grains is expected to continue.

Philippines: Hanging abaca fibre in the sun for drying. The Philippines provide almost the whole of the world's abaca production

Hard fibres

Hard fibres—abaca, sisal and henequen—are almost entirely used for making industrial ropes, agricultural twines and marine cordage.

Increased industrial demand for ropes and twines pushed up prices of hard fibres, although production of the fibres in 1959 reached a record total of 845,000 metric tons. In 1960 production is expected to be still higher and at present is estimated at 855,000 metric tons.

Among the three fibres, sisal production rose most, from 532,000 tons in 1958 to 558,000 tons in 1959. In 1960 it is expected to rise to 570,000 tons.

Abaca rose from 113,000 tons in 1958 to 121,000 tons in 1959, but in 1960 is likely to decline to 116,000 tons. Henequen production has been rising slowly. From 132,000 tons in 1958, it rose to 134,000 in 1959 and in 1960 is estimated at 137,000 tons.

The big increase in sisal mainly came from *British East Africa* and *Brazil*, which grew about 70% of the world's sisal. Abaca production in the *Philippines*, which supplied almost the whole of the world's abaca, showed some recovery. Central American countries—*Guatemala* and *Costa Rica*—ceased to grow any abaca after 1959. Henequen was mostly grown in *Mexico*, with *Cuba* adding about 10% of world production.

FAO reports that the demand for hard fibres for industrial ropes and padding rose with the high level of industrial activity in all parts of the world, while exceptional grain and hay harvests in Western Europe and North America raised the demand for agricultural twines. Towards the end of 1959 there were definite indications that hard fibres would soon be in short supply.

Australia

Australia may soon become self-sufficient in *safflower seed* if the current rapid rate of expansion continues. The major factor in any further increase, however, is the relationship between returns for wheat and wool and the price guarantee for safflower.

The first substantial commercial sowings were made in 1956-57, when 928 harvested acres yielded 240 tons of seed. Encouraged by the Queensland Department of Agriculture and favourable marketing conditions in 1958, the area sown to safflower in Queensland increased from 7,736 acres yielding 1,840 short tons of seed in 1958-59 to about 10,000 acres in 1959-60.

Following the success of the crop in Queensland, growers in New South Wales became interested and have been planting 400-500 acres in recent years. Trial plantings also have been made in Western and South Australia (see p. 339).

An estimated 3,585 tons of seed that were crushed from the 1958 and 1959 harvests produced about 880 short tons of oil. As Australian annual consumption is about 3,150 tons and is rising, a large proportion of the oil needed is still being imported. Australian use of safflower oil is largely confined to the paint and resin industry. Smaller quantities are used by the linoleum industry and in edible vegetable oil blends.

Iran

Iran's 1959-60 *cotton* crop, now estimated at 330,000 bales (500 lb. gross), will set a new record for the third successive year. This season's crop is 3% above the 320,000 bales grown in 1958-59 and 15% above the 287,000-bale average of the past five seasons.

The record crop is attributed to a 4% acreage increase—from 640,000 acres in 1958-59 to 665,000 acres—and to favourable weather. Production may decline in 1960-61 because dry weather this winter made soil moisture conditions less favourable.

U.S.S.R.

Late spring rains and warmer weather in the European U.S.S.R. have brightened crop prospects there for 1960. Earlier in the season severe dust storms in the Southern Ukraine and North Caucasus blew out winter crops and portended another drought like that of 1959 in the 'breadbasket' area of the U.S.S.R. But the Government is now more optimistic about the coming grain harvest; only a few sections in the Volga region report soil moisture deficiencies. Some damaged winter grain areas have been resown to *maize*, and the *wheat* acreage in the 'new lands' area has been expanded to compensate for some of the loss. Winter wheat is beginning to fill out and the harvest season is approaching in the Southern Ukraine and North Caucasus.

A spring sowing of about 2½ million acres of monogerm *sugar-beet* seed, or about one-third of the U.S.S.R.'s sugar-beet acreage is reported. Monogerm seed, traditionally planted mainly in the Ukraine, is being sown this year in other areas also. The major sugar-beet areas outside the Ukraine are in the North Caucasus, Kazakhstan and parts of Siberia and the Far East. The wider use of monogerm sugar-beet seed will greatly reduce the amount of hand labour previously expended in blocking and thinning the stands produced by the multiple seed.

Sweden

The Swedish *rapeseed* crop soon to be harvested is forecast at 80,000 short tons, which is 45% less than the 1958-59 crop of 142,860 tons. Dry weather at planting time last autumn materially reduced the area sown and resulted in poor stands. There are indications that winter loss was above average in some areas, and this could reduce the out-turn below this estimate.

Mexico

Mexico's *rice* harvest in 1959-60 (August-March) is now estimated at 5,200,000 cwt. (100 lb.) of rough rice. This is 10% below a previous estimate of 5,750,000 cwt., and is less than the record output of 5,550,000 cwt. in 1958-59. A sharp decline in the Veracruz crop offset increased output in the states of Sinaloa and Sonora.

The revised acreage estimate for 1959-60, at 297,000 acres, is only slightly lower than 299,000 in 1958-59. It is, however, 26% above the average from 1950-51 through 1954-55.

Next season's rice acreage is forecast at around 340,000 acres, 14% larger than that of the recent harvest. The outlook for 1960-61 is for increases in most districts. Sinaloa, for instance, is expected to put 25% more acreage into rice.

England and Wales

On 1 July, the autumn-sown *wheat* looked very well on the whole; some 'take-all' was reported from several areas. Autumn-sown *barley* and *oats* were healthy and vigorous; lodging due to localised heavy showers was reported from a few areas. Spring-sown wheat made good progress, except where adversely affected by dry soil conditions. On the whole, spring-sown barley was promising, though mildew and lodging were frequently reported. Spring-sown oats were satisfactory, but some crops had been checked by frit-fly damage and mildew was occasionally reported.

Mixed corn was satisfactory and *rye* good. Winter and spring *beans for stockfeeding* on the whole were healthy and vigorous; some damage resulting from blackfly attacks was reported. *Peas for stockfeeding* were fairly satisfactory, although some crops were adversely affected by the dry conditions.

Most *first early potato* crops looked well, but on the whole were bulking slowly, except on irrigated fields, and yields were expected to be slightly below average. Lifting was delayed in many areas. *Second early and maincrop potato* varieties generally were promising; some crops were uneven, mainly due to dry conditions.

Sugar-beet, which made good growth during the month, was a healthy crop. *Mangolds* made satisfactory progress, though some crops were uneven due to dry conditions. Early sown *kale* crops generally were strong and healthy, but in some areas later sown crops germinated unevenly and growth was slow. Pigeon damage was reported from a few eastern counties. *Turnips and swedes* were satisfactory in most areas, although some crops are patchy and making slow growth due to the dry weather conditions.

Acknowledgment is made to *For. Crops. Mark.* for much of the information contained in the above reports.